The Dock & Harbour Authority

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The Dock & Harbour Authority

No. 331. Vol. XXIX. MAY, 1948

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Editorial Comments

The Port of Dublin.

In this issue, through the courtesy of the Institution of Civil Engineers of Ireland, we publish a paper read by Mr. F. A. Bond, M. Inst., C.E.I., and discussed at an Ordinary General Meeting of the Institution on the 1st March, 1948.

The work described in Mr. Bond's excellent paper was one of those most difficult of operations a civil engineer has to contend with —the re-construction of dock walls on the site of old ones—in this case the re-construction of Custom House Quay—Dublin.

The docks at Dublin were originally built about 140 years ago with various additions and reconstructions of different designs built in 1843, 1867, 1907 and 1914, in the Custom House Quay area, the whole site presenting diverse types of walls and strata.

Engineers cannot usually afford to make errors and learn by them, for they have life, plant and property at stake, but they do benefit by the difficulties they themselves meet with and surmount and by studying the problems overcome by other members of their profession.

This paper is therefore most welcome and will be read with interest by engineers, for unlike many descriptions of civil engineering construction Mr. Bond's paper presents frankly and clearly all the difficulties experienced. Indeed the outstanding feature of the whole enterprise is the description of the methods and masterly improvisations adopted in overcoming site difficulties, deficiencies in materials, plant breakdowns and so on.

Even the design of the new quay walls was dictated largely by the adverse supply situation and other conditions resulting from the outbreak of war, while the lack of suitable plant and materials accentuated the ordinary difficulties which are more or less to be expected in work of the type described.

The paper describes the various types of walls considered for the new work and the reasons why they were discarded in favour of gravity type mass concrete walls built in cofferdam. That between Commons Street and Georges Dock Entrance was built in front of the old quay wall in order to provide adequate quay space for the operation of electric portal cranes and for the discharge of cargo direct on to road vehicles behind the transit shed, and work was commenced in May, 1941.

The Western section of the Quay, commenced in April, 1947 and not yet completed, is similar in design to the Eastern section except that opposite the Custom House where the new wall is being built approximately on the line of the old one.

In respect of the costs involved in the reconstruction, in work of this character it is always difficult to obtain true comparisons with other enterprises, for no two jobs are precisely comparable. Having regard however to the difficulties and the delays due to the lack of suitable materials, breakdowns of plant and war conditions generally, the cost of the work does not appear to be excessive.

The New Marine Airport at Southampton.

On 14th of April last, Lord Nathan, Minister of Civil Aviation officially opened the Marine Air Terminal at Southampton. In his opening remarks, Lord Nathan said it was fitting that the name of that great seaport should be associated with flying-boats. Southampton had developed and expanded until today it contained the largest docks for ocean-going ships in England, and had become one of the greatest passenger ports of the world. The association of flying-boats with Southampton might seem of relative insignificance, but aviation had made history in a very few years.

Referring to the difficulties experienced in finding suitable sites for marine bases, Lord Nathan observed that in the case of the United Kingdom there were a number of particular problems to be considered. Because we were a maritime nation it was only to be expected that most of the suitable ports had already been developed for shipping purposes, and there must be no undue interference with our shipping in developing marine bases. Also, a marine airport must have the right operational characteristics and dimensions, there must also be scope for developing adequate alighting and take-off areas free of obstructions, depth of water, and various other factors. He believed Southampton terminal was a solution to the problem.

Sir Harold Hartley, chairman of the British Overseas Airways Corporation said that Southampton Water offered such exceptional facilities for flying-boat operations that it was made the base for the Empire marine air services when those were started. During the recent war the terminal had to be transferred to Poole, but now they were returning to Southampton to operate in new and better conditions.

Services would fly from Southampton to South and East Africa, the Middle East, Pakistan, India, the Far East and Australia. Two services would be flown jointly with two Commonwealth partners who would use the latest type of land planes. It would be a very interesting experiment to see how the public would choose between the more speedy land planes and the more roomy flying-boats.

An account of the new Marine Terminal will be found elsewhere in this issue, and the following brief description of the various responsibilities exercised by the Ministry of Civil Aviation, the Harbour Master, and British Railways, will, no doubt, be of interest.

When flying-boats are in the area, Control is taken over by the

Editorial Comments – continued

Ministry of Civil Aviation Marine Air Port Control Launch. Before any flying-boat is permitted to touch down on the water, the Harbour Master, through his Control Officer, (who is a Master Mariner), assures the flying-boat Commander, through the M.C.A. Control Officer on duty that the area is free from shipping or other obstructions. Should any shipping be navigating in the alighting or take-off area the Harbour Master must ensure that priority of movement is accorded the ship, and in this case the flying-boat would be instructed to remain air-borne until the area is clear.

The same priority is afforded shipping when flying-boats are preparing to take off.

For the purpose of applying the International Regulations for Preventing Collisions at Sea, the local Bye-Laws, flying-boats when water-borne, are regarded as surface vessels, and must conform to traffic regulations laid down. The flying-boat either taxies or is towed to a special retractable mooring buoy situated adjacent to the Pontoon Dock. A wire is then attached to the tail of the craft and an electric winch warps her into the special dock. The passengers then embark or disembark by the Pontoon gangway.

Immediately the flying-boat is secured to the mooring buoy off the terminal berth, No. 50, the Harbour Master's responsibility is ended, and is not resumed until the flying-boat is re-secured to the mooring buoy prior to departure. The Docks and Marine Manager, British Railways (Southern Region) is responsible for Berth 50 and the aircraft while it is in the dock.

The British Overseas Airways Corporation is, of course, responsible for operations in collaboration with the above mentioned authorities, and the staff of all grades at Berth 50 are under the B.O.A.C. Station Superintendent, who is in charge.

Topical Port Problems.

During the past few weeks, a number of problems relating to the efficient working of the ports of this country have been discussed both in the press and at meetings of various bodies connected with the industry, and as some of the subjects dealt with are of great interest and importance, we are reproducing in this issue abstracts from three speeches delivered at three meetings held recently in London.

At the Spring Meeting of the Institution of Naval Architects, nine papers were read, and of these, the one of greatest interest to both the port and shipping industries was the first, entitled "Speed at Sea and Despatch in Port," by Mr. W. MacGillivray. The author drew attention to the existing delay factors in the turn-round of shipping in ports and showed how these nullify the shorter voyages which the modern cargo vessel is able to attain as compared with pre-war figures. In the discussion which followed, the author remarked that "if the owners said too much" about restrictive practices, absenteeism, "spelling," and other habits of dockers which militate against speedy turn-rounds in port, "there would be an unofficial strike."

It is obvious that the shipping shortage and port congestion is accentuated through these delays and if only these adverse conditions could be overcome, an improvement in ship turn-round would result. In this connection we cordially agree with a recent comment in the "Journal of Commerce" that it is unfortunate that "Mr. MacGillivray's perspicacious paper will probably have its circulation limited to the technical Press and members of the institution, for the figures which are given, and the facts brought to light, would provide many laymen with food for thought, and would surely prove that the concern which owners have frequently expressed has more justification than many are inclined to admit."

A second paper, delivered by Mr. W. A. Flere before a meeting of the Institute of Transport and entitled "The Future of British Ports and Canals," also contained a number of suggestions that merit attentive study. The author dealt in some detail with the historical background of the ports of this country and gave an analysis of their present capabilities and discussed the problem of those that are becoming redundant.

With regard to the practicability of his suggestions for the future working of the ports, however, there will be many divergent views. His proposal for a regional grouping of the ports appears to be on somewhat similar lines to the recent war-time arrangement, although the actual areas now advocated differ geographically—no doubt to fit in better with peace-time trading conditions, as the war-time groupings were largely governed by the Convoy routes. Whether such a scheme could be made to work successfully is a debatable point, and the smaller ports in particular, are likely to raise strong objections to the plan. More especially will they disagree with the inference that they are losing their usefulness owing to the increase in the size of modern cargo ships.

All dock and harbour engineers will endorse the author's concluding remarks concerning the need for research and development, particularly on the port engineering side, as "ports are so costly and have such high annual maintenance charges (the price of interfering with natural river and sea phenomena, overcoming tidal difficulties, etc.), that a port research establishment is essential."

When considering the future of the ports, it should be always borne in mind that, however efficient the equipment of a port may be, no lasting success can be achieved without a contented and efficient labour force. The speech of Lord Ammon at the eighth and last Annual General Meeting of the National Dock Labour Corporation, Ltd., was therefore encouraging, as it showed that the permanent scheme of dock labour decasualisation which became law nearly a year ago, has made a favourable start.

The need for taking the fullest advantage of the more settled working conditions, and the hope that the utmost effort would be forthcoming from all engaged in the industry was stressed at the same meeting by Mr. Ernest Bevin, the Foreign Secretary, when he appealed to "every employer, trade union official and dock worker" to make the best possible use of the assistance being supplied by the United States of America under the European Recovery Programme.

"If it is handled rightly by the manufacturers and workers of this country it will spread 20 or 30 per cent. further than it would in any other way. Prices will go down all over the world, particularly if we have a good harvest. Used wisely, it could mean big production in Europe and a lowering of production costs. That will mean the raising of the real money value of our wages."

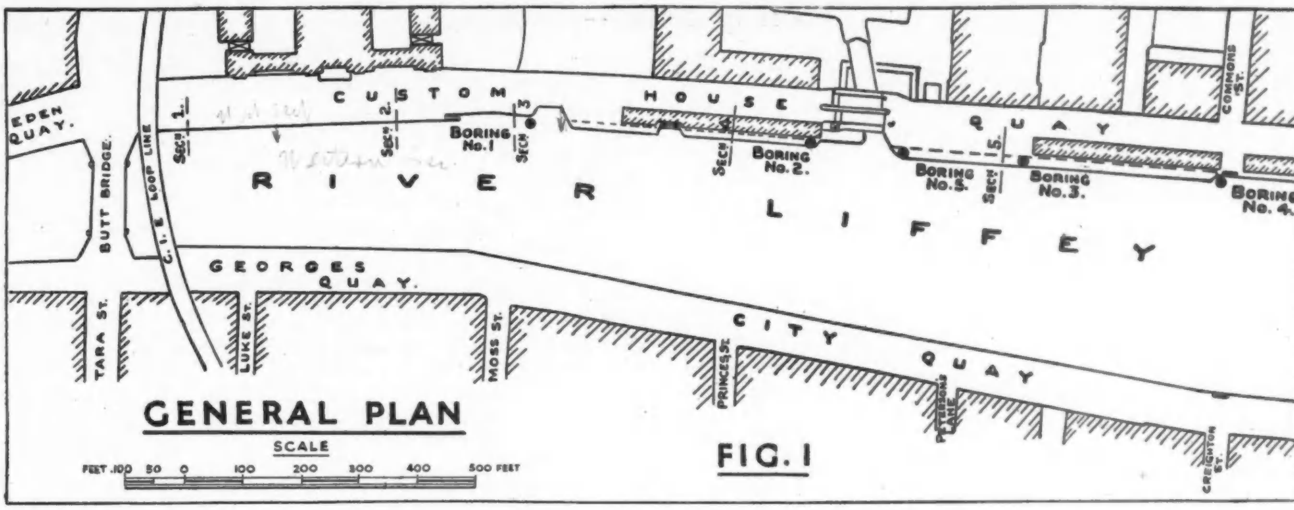
With the advent of the Marshall Plan, this country had a very special obligation, and the dock labour industry was right in the forefront. In the war, he met the dockers in Caxton Hall and spoke to them on the question of a quicker turn-round of ships in the ports. To-day, with a combination of effort on the part of the management and the men, he thought it would be possible to cut at least another three days off the turn-round time.

"This is the critical year in Britain's recovery effort," concluded Mr. Bevin, "If output goes up, turn-rounds are speeded up, cargoes handled with dexterity, and if we can get the biggest possible value out of Marshall aid, to use the next three years in putting our economy on a sound basis, we shall have restored our independence."

Folkestone Continental Services to be Resumed.

It was officially announced last month, that Folkestone Harbour would reopen as a passenger port early in May. The restarting of the Folkestone-Calais route on the 8th instant, followed by the reinstatement of the Folkestone-Boulogne service on 18th June, will mean the welcome return of trade to the harbour and the re-employment of a substantial number of men. A definite date, October 2nd, has already been given for the termination of the Folkestone-Boulogne service, but no date has so far been mentioned regarding the termination of the Folkestone-Calais route. Endeavours are being made by the interested parties to persuade the British Railways Executive, (Southern Region), and the French National Railways to keep this service running all the year round.

Until the outbreak of the recent war, Folkestone's link with Boulogne had remained unsevered for a great many years, and the two towns have always been closely connected by trade associations. The route—the shortest by land and sea from London to Paris—has always been very popular during the summer months, but whether it will be kept open during the winter remains to be seen. No doubt the prevailing austerity conditions and the currency restrictions will have a decisive bearing on any decision which may be made.



The Port of Dublin

Reconstruction of Custom House Quay*

By F. W. BOND, B.A., B.A.I., M.Inst.C.E.I.

Introductory

CUSTOM HOUSE QUAY extends for a length of about 1,900 feet along the North side of the River Liffey from Butt Bridge to Commons Street and is divided into three sections by the entrances to the Old Dock, now disused and filled in, and to George's Dock. The Western section of the quay, from Butt Bridge to the Old Dock entrance, is about 700 feet long and is used as an allocated berth by Messrs. Arthur Guinness & Son. For a length of 200 feet from Butt Bridge the quay wall is of granite faced masonry resting on double timber sheet piles backed with concrete. These piles are driven to a depth of about 16 feet below L.W.O.S.T., the bottom of the concrete backing being believed to be about 8 feet below L.W.O.S.T. The wall has a batter of 1 in 6, decreasing to 1 in 7 at the top, and there is a depth of 8 to 10 feet at L.W.O.S.T. in the berth. This wall was built about 1867 in front of an older wall founded a few feet below L.W.O.S.T.

The next 500 feet Eastward consists of a similar wall carried on cast iron sheet piling, driven in the year 1848 to depths varying from 10 to 18 feet below L.W.O.S.T., while at the Old Dock entrance the wall is of rubble masonry, granite faced, founded about a foot below L.W.O.S.T. and supported by a small masonry apron with timber sheet piles driven about 9 feet below L.W.O.S.T.

***A Paper read and discussed at an Ordinary General Meeting of the Institution of Civil Engineers of Ireland, held on March 1st, 1948, and reproduced by kind permission.**

Between the dock entrances, a length of about 500 feet, there is a very old masonry wall, founded at or about L.W.O.S.T., fronted by two narrow timber jetties, built in 1914 to replace two older jetties. The piles for those jetties were driven to refusal at depths of 12 to 15 feet below L.W.O.S.T. and the berth provides a depth of only about 8 feet at L.W.O.S.T., rock being actually exposed at this level at one point.

From George's Dock entrance to Commons Street, some 550 feet, the old wall was similar but fronted for part of its length by a masonry apron and short timber sheet piles, with a timber jetty 20 feet wide carried on piles driven to an average depth of about 17 feet, the depth in the berth being about 14 feet at L.W.O.S.T. East of Commons Street there is a deep quay wall built in coffer-dam in the year 1907.

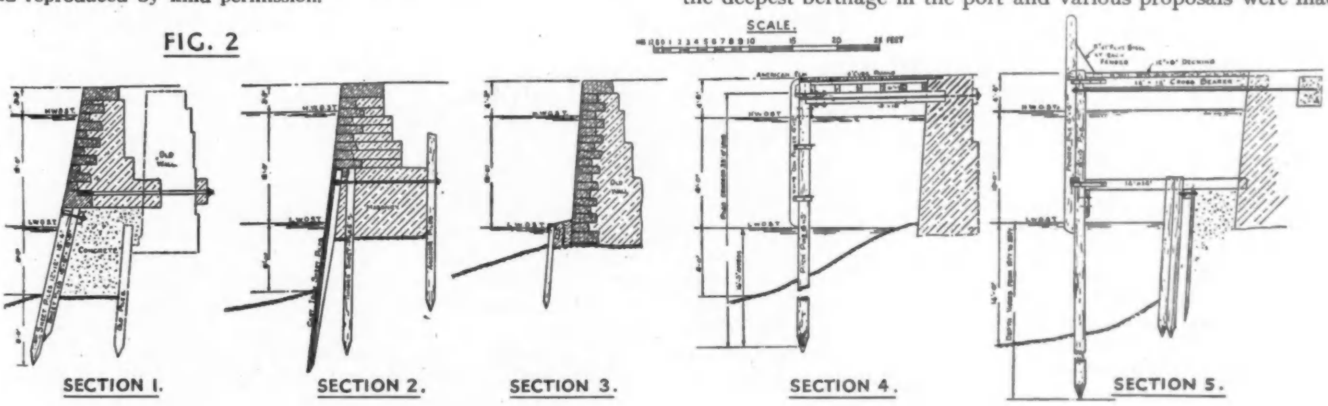
On the last two sections of the quay there were old single storey transit sheds.

Figures 1 and 2 show a plan and typical sections of the quay as it existed in 1939.

Owing to its proximity to the city and to the extensive ware-houses in the Custom House Docks, Custom House Quay has always been recognised by the Dublin Port and Docks Board as being of particular value, and schemes for reconstruction have been prepared at various dates. In 1920 the Board obtained parliamentary powers to reconstruct the quay at a cost of £100,000, but no work was actually done, mainly owing to uncertainty as to the future development of the Custom House Docks.

These docks were originally built about 140 years ago to provide the deepest berthage in the port and various proposals were made

FIG. 2



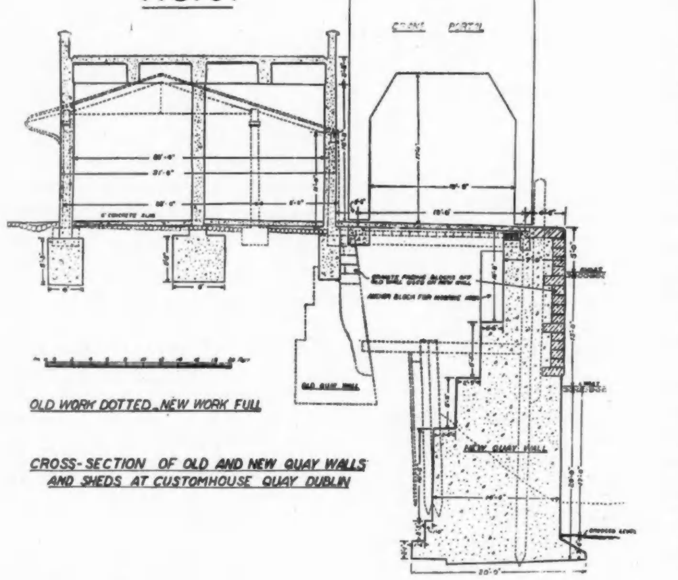
Port of Dublin—continued

for their reconstruction, involving substantial alterations to Custom House Quay. Later, however, it became evident that owing to the restricted width of the river and the known presence of rock at a relatively high level it would be almost impossible to convert the docks to accommodate large modern ships, and accordingly it was decided to provide deepwater quays at the Eastern end of the port and develop the Custom House Docks mainly as a warehousing estate. Consequently it became possible to prepare definite designs for the rebuilding of Custom House Quay, retaining the existing entrance to George's Dock, and in 1939 the Port and Docks Board sought and obtained additional borrowing powers for this work. By this time the matter had become rather urgent, as the wooden jetties had been badly attacked by marine borers, diver's reports indicating that most of the piles had been reduced from 14 inches square to about 5 inches diameter.

Design

A series of trial borings was made early in 1939, and disclosed that between Commons Street and the entrance to George's Dock limestone rock occurred at levels between 23 feet and 42 feet below L.W.O.S.T. West of the dock entrance, however, rock was found 17 feet below L.W.O.S.T. and opposite the Old Dock entrance at 12 feet. Between these points rock had already been exposed at a depth of 8 feet, while at the Northern end of Butt Bridge it had already been found at a depth of 14 feet below L.W.O.S.T. The overlying strata consisted in all cases of a fairly thin layer of mud, about 10 feet of gravel and clay, and varying depths of boulder clay.

FIG. 3.



OLD WORK DOTTED. NEW WORK FULL

CROSS-SECTION OF OLD AND NEW QUAY WALLS AND SHEDS AT CUSTOMHOUSE QUAY DUBLIN

It was at once evident that it would be impracticable, or at least uneconomic, to construct very deep berthage West of George's Dock entrance and that the whole of this length of the quay wall would be founded on rock. East of the dock entrance, however, these considerations did not apply and the design of the quay was dictated by the type of traffic likely to use it. It was finally decided that berthage suitable for vessels up to 16 feet draught at all stages of tide would deal adequately with the traffic, which was expected to be of cross-channel and continental origin.

Various methods of construction were considered, including reinforced concrete piling and caisson construction. The final choice, which was dictated by the outbreak of war and the resulting situation rather than by engineering considerations, was a mass concrete gravity type wall constructed in cofferdam. It may be said, however, that experience in the driving of wooden piles for the old jetties had shown that the ground was extremely hard and likely to cause great difficulty in the driving of reinforced concrete piles, while the condition of the old quay walls, which retain the heavily loaded roadway, was far from satisfactory, so that the construction of reinforced concrete jetties in front of them would not alone have provided a satisfactory solution.

Further, the founding of caissons of the type used elsewhere in the port would have been impossible, as the preliminary dredging would certainly have led to the collapse of the old walls, while the sinking of open or compressed air caissons appeared likely to be unduly costly for a wall of this size.

West of the George's Dock entrance it was evident that neither piling nor caissons would be suitable owing to the high level of the rock unless the depth of the new berth was to be unduly restricted. On plotting a longitudinal section of the rock stratum, it appeared that the maximum depth which could be obtained without excessive rock excavation would be sufficient to enable vessels of 15 feet draught to lie afloat at all stages of the tide and while a greater depth would have been desirable it was accepted that this would meet the needs of many vessels in the Cross-channel and Continental trades. It was, therefore, decided in this case also to construct a mass concrete wall in cofferdam, founded on rock at or below 15 feet below L.W.O.S.T. with a trench cut about three feet into the rock to form the toe of the wall, and subsequently to remove the rock above foundation level in the berth either by blasting or rock-breaker.

Dealing in rather more detail with the length of quay between Commons Street and George's Dock entrance, which is the only section so far completed, it was decided to build the new wall in front of the old, the front of the new wall being approximately on the line of the old timber wharf.

The purpose of this was to provide sufficietnt quay space for the operation of electric portal cranes and for the discharge of cargo direct on to road vehicles, while at the same time allowing for the building of a new transit shed on the site of the old shed. This new shed, which will be more fully described later, was designed to be a single storey building with a flat roof suitable for the landing of cargo by the cranes, the intention being that at a later date overhead conveyors would be installed for the direct transfer of goods ex-ship to the warehouse on the opposite side of the road.

The quay wall was designed to be founded on clay at a depth of 20 feet below L.W.O.S.T., the foundation sloping slightly downwards to the back of the wall. The front of the wall was to be vertical, with a small corbel one foot above L.W.O.S.T., from coping level (18 feet above L.W.O.S.T.) to within 2-ft. 6-in. of foundation level, at which point a toe, projecting 2-ft. 6-in., was provided. The back of the wall was stepped, the maximum width at foundation level being 20 feet and the width at coping level 7 feet. Fig. 3 shows a general cross section of the old and new walls and transit sheds.

It was decided to face the wall from coping level down to one foot above L.W.O.S.T. with granite blocks, using the facing stones of the old wall as far as possible, in order to avoid the elaborate fendering required for concrete quays. The remainder of the old wall was to be left in place to act as a foundation for the South wall of the new transit shed.

Construction (Eastern Section)

Following the outbreak of War, there was a very serious reduction in the revenue of the port, owing to the decrease in the amount of shipping entering and this, combined with shortage of materials, forced the Port and Docks Board to reduce expenditure and close down various works. In 1940 it became evident that a heavy cut in maintenance expenditure would be necessary and could only be made by paying off a number of long-service employees. The Board, therefore, decided, if possible, to undertake some of the capital works for which it had already secured borrowing powers and transfer these men from maintenance to capital account. It was evident that the only work which could be undertaken with the scanty materials available and little prospect of getting more was the reconstruction of Custom House Quay, and after careful consideration it was decided that this would be practicable.

Sufficient steel piling of different lengths and sections was available for a cofferdam about 120 feet long and by stripping

Port of Dublin—continued

other suspended works, enough timbers for walings and struts were collected. No timber was available for the usual piled staging for cranes, so it was decided to use a stationary grab dredger, the *Mudfisher*, fitted with two steam cranes and a steam driven concrete mixer, for the construction. A No. 7 McKiernan-Terry hammer was available and it was found possible to purchase an extractor. Later a secondhand No. 6 hammer and extractor were also obtained. Pumps available were a 12-in. petrol-paraffin engined salvage pump, a 6-in. submersible pump with petrol/paraffin engined generator and a 4-in. centrifugal pump. It was obvious that fuel for these would not be available, so the 12-in. pump was converted for belt drive by electric motor and the submersible pump generator direct coupled to a suitable 3-phase motor. The 4-in. pump was also fitted for belt drive by an electric motor.

A portable petrol driven air compressor was converted by removing the compressor from its chassis, fitting a driving pulley and mounting it with an electric motor on a specially constructed frame made of old steel piles.

Additional reservoir capacity was provided by connecting the compressor to a large storage cylinder, formerly the container of a gas light-buoy.

Work commenced in May, 1941, collecting materials and adapting plant and in June site work began, starting at the Eastern end of the quay, an electric power supply being installed and part of the old transit shed demolished. Removal of the old wharf was started in July, the piles being drawn by the "Bell Float," an 80-ton floating shears built for carrying the diving bell. Any timber fit for re-use was carefully put aside, but most of it was rotten and useless.

Piling of the first cofferdam started on the 17th July, 1941, the back piling being driven first owing to the limited radius of the available cranes. Driving proved extremely difficult, few of the piles being driven to the designed depth. A 1-ton single-acting steam hammer on a floating piling frame was tried experimentally, but the results were not very satisfactory. Six weeks were required to drive the back row of piling, about 120 feet long.

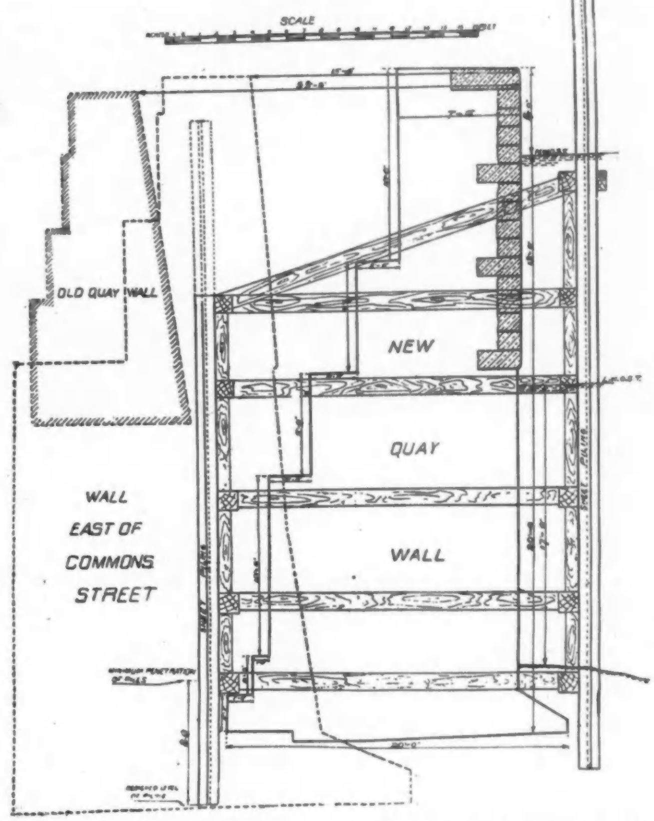
These piles were Larssen No. 4 section, 29 feet long, and it was intended that they should be driven to 22 feet below L.W.O.S.T., there being no necessity for the heads to reach high water level, but in fact the penetration was in many cases 7 to 8 feet less.

Rather better progress was made in the driving of the front piling and cross dams, where the bottom level was lower and penetration less, and the first cofferdam was closed on the 14th October, 1941, the upper walings and struts having been fitted and four timber piles driven inside the dam to carry the main 12-in. pump. It was necessary to keep this at as low a level as possible, in order to have a practicable suction head, and a long belt drive was used, the motor being mounted on top of the old quay wall. During the early stages, when only two sets of struts were in place, water level had to be allowed to rise inside the dam at high tide and it was necessary to remove the driving belt from the pump on each occasion, resulting in considerable delay in resuming pumping on the ebb tide, as only the 6-inch pump was then available. As soon as the third set of struts, at L.W.O.S.T., had been completed, it was possible to keep the water level below the pumps at all times. The dam was provided with several flap valves to prevent any possible reverse head due to flooding, and also contained two "sluice piles" which could be lifted to flood the dam rapidly if necessary.

Fig. 4 shows a cross-section of the cofferdam and quay wall, from which it will be seen that the upper set of struts slope downward from the front waling, 11-ft. 6-in. above L.W.O.S.T., to butt against the back waling of the second set, 5-ft. above L.W.O.S.T. This arrangement was necessary because it was impossible to get a solid bearing for the back waling at the higher level, owing to the irregularity of the back piling. These struts, however, carried no load, except at high tide, and as the thrust then was small they were made of half timbers, mostly about 12-in. by 6-in. The main sets of struts, five in number, were generally of 12-in. by 12-in. Oregon or Pitch Pine, though some round logs of native Larch had to be used to make up the numbers. Heavier logs were used for the walings where possible. Spacings between sets varied from 6-ft. 6-in. to 4-ft. 6-in., the lowest set being 3 feet above foundation level. Struts were placed at approximately 8-ft. horizontal intervals. There was a good deal of difficulty in "making up" between the walings and the steel piles, owing to the fact that some of the front piles were of No. 2 and some of No. 4 section Larssen, while the very hard driving had made it impossible to keep them straight, some of the piles twisting while driving. In addition, every second pile was in two lengths, with butt joints, and the short piles did not guide the adjoining long piles very satisfactorily. These butt joints at first gave a good deal of trouble through leakage, but this was cured fairly satisfactorily by applying duck canvas and tar and filling the locks with ashes and turf mould.

The top waling was bolted to the steel piles, the remaining walings being kept in position by vertical tie bars and distance pieces. Only one external waling, of 12-in. by 6-in. timber, was used owing to shortage of material.

FIG. 4.



At the East end, the cross piling abutted on the deep quay wall. As this wall had a projecting toe, three piles landed on this and could not be driven, while one had to be cut to suit the batter of the wall. The final joint had to be made with shaped timber fitted by divers, the corbel on the existing wall causing some difficulty. The back piling, which was driven immediately in front of the old wall, between it and the old timber sheet piling, was driven as close as possible to the existing deep wall, the line of which was about 5 feet in front of the old wall, but was not actually joined to it or to the cross piling.

At the West end, a junction pile was included in the front piling about 10 feet East of the cross dam, so that on completion of the first section of the new wall cross piles could be placed and the joint to form the East end of the second dam made in the dry inside the dam.

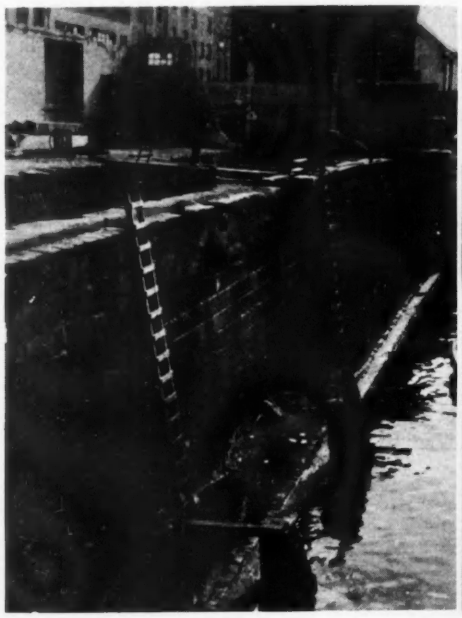
No particular difficulty as regards leakage was experienced and it was found that the 12-inch pump was seldom required once

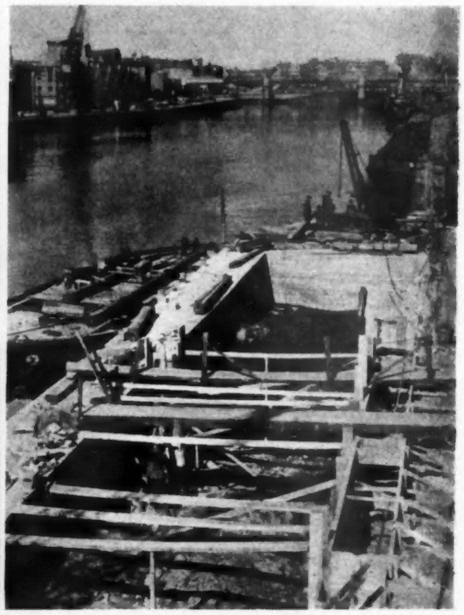
Port of Dublin—continued

the " seal " on the dam was established, the 6-inch pump being easily able to deal with the leakage, most of which took place through and under the old wall. Excavation, however, was very slow, the material proving to be a very tough boulder clay and very much harder than had been indicated by the test borings. It was found necessary to excavate practically all material with pneumatic spades. The spoil was removed in ordinary skips and dumped in the river against the outside of the piling to form a foreshore, to prevent " blows " and to check any tendency for the dam to move outwards at low tide. To assist in checking this tendency, diagonal wire ties were fitted from the top front waling to one of the lower back walings.

which had to be lost on each occasion. This was a serious matter owing to the scarcity of timber, and the oldest available scrap timber had to be used. This was just sufficient to keep the concrete from making contact with the piles and making them impossible to withdraw. The back walings were removed as construction proceeded, the piles being shored off the back of the wall at intervals, but the front walings were left in, to float out when the piling was extracted, the tie bolts being removed before flooding the dam.

At the East end the wall was carried back at an angle of about 45° to the face to join the existing deep wall, which was 15 feet 8 inches behind the face of the new wall.





Left: Back piling for first cofferdam being driven in front of old wall, old shed demolished. Centre: Extraction of sheet piling, showing typical condition of toes. Right: Filling between old and new walls and constructing fendering on East side of Dock Entrance. Also shows old wharves and sheds West of Dock Entrance.

Excavation to foundation level was completed without incident early in February, 1942, 16 weeks after the closing of the coffer-dam. Concreting was carried out with a steam driven 30/21 cubic feet mixer mounted on the dredger *Mudfisher*, dredged gravel being used as aggregate, the mix being 560 lbs. of cement to the batch for the first layer and 448 lbs. of cement per batch thereafter. Gravel was brought alongside in barges or hoppers and fed to the mixer by a grab attached to one crane, while the concrete was lowered into place in a bottom dumping skip on the other crane. Concreting was commenced at the Eastern end and arrangements were made to keep water from reaching the unset concrete by leading it to the sump at the Western end by piped channels laid on the foundation bed from the East end, back and front of the dam. The sump itself was timbered and left open to form the sump for the second dam, a concrete base for the pump motor being incorporated in the Western end of the new wall, and on completion of the second section of wall this was concreted up to form a key between the two sections.

Concreting was carried out in lifts of about 3 feet, alternate lifts being concreted in three and four sections in order to break joints, and keys being formed in the end of each section. Large stones were used to form keys in the horizontal joints. The struts were boxed in and concrete poured between them in each lift. Relieving struts were then placed between each pair of struts as soon as the concrete was sufficiently hard, the struts removed and the recesses concreted with the following lift.

The width of the dam being only 21 feet between piles and the bottom width of the wall being 20 feet, there was no room below the bottom waling to recover the casing to the toe of the wall,

Concreting was completed to a level of 1 foot above L.W.O.S.T. in five weeks, and above that level the face of the wall was built up with granite blocks, the concrete backing being poured in lifts of rather less than 3 feet to avoid excessive pressure on the masonry during pouring. Facing stones were omitted where struts occurred and the procedure already described followed for relieving the struts. This work was of necessity rather slow, as the stonework had to be allowed to set before concreting could commence, and it took over 10 weeks to raise the wall to a level of 16-ft. 6-in. above L.W.O.S.T., at which level the heavy granite coping stones were set. All the stones used had to be redressed to a vertical face, having been cut to the batter of the old wall from which they were removed.

As soon as the work had reached the level of high spring tides, pumping was stopped and the dam flooded.

The removal of the sheet piling was then started, using at first a floating shears (the Bell Float). This, however, proved very slow, the piles being as hard to draw as they were to drive. Many of the toes were damaged and large masses of boulder clay came up with the piles. The McKiernan-Terry extractor was then tried on one of the *Mudfisher's* cranes, fitted with a short jib, and proved quite satisfactory, until one of the stay rods of the crane failed, allowing the jib to fall and causing considerable damage to the crane, which took a fortnight to repair. Meanwhile, removal of the front piles with the floating shears was resumed and completed in three weeks.

It should be explained that the cranes on the dredger, *Mudfisher*, were provided with two jibs each, one about 60 feet long with a working load of 3½ tons, the other a short jib used for

Port of Dublin—continued

dredging. While the long jib was capable of driving the back piles, as well as excavating and concreting, it could not take the extractor, which required at least a 5-ton crane.

The back piling being out of reach of both the shears and the cranes, a 5-ton steam crane was landed on the new wall by the floating shears and the extractor was tried on it. It was found, however, that the piles could not be moved with the maximum lift on the crane and it was, therefore, decided that it would be necessary to increase the outreach of the floating shears. A ship's derrick, about 50 feet long, which had been washed ashore some time previously and purchased from the Receiver of Wreck was rigged, the lower end being secured to a timber pad attached to the base of the shears and the upper fixed at a suitable outreach. A special fitting was made and secured to the upper part of the derrick, with a sheave at each side. The extractor was hung from a bridle piece, from which wires passed over the twin sheaves to an equalising sheave, shackled to the wire from the main winch drum. This arrangement proved completely successful, being equivalent to a 20-ton shears with an adequate outreach.

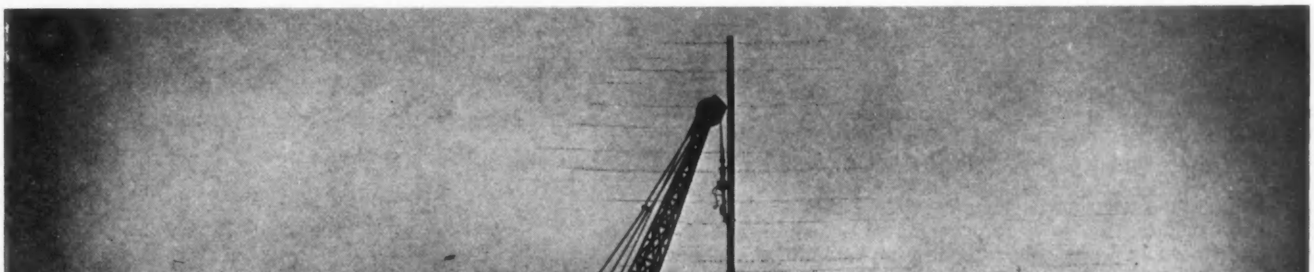
While these adaptations were in progress, demolition of the second section of the old wharf was carried out and the West cross piling removed. Sufficient short piles were available to start the back piling of the second dam and the front piling already drawn from the first dam was re-driven.

As the back piles were removed from the first dam they were re-driven to complete the second dam, which was practically identical with the first. At this period fuel supply difficulties were particularly acute and there was very great difficulty in maintaining a full head of steam for the extractor and hammer, with the result that there were many stoppages. Further, although the ground was rather softer than in the first dam, the piles were not fully driven owing to the inefficiency of the hammer, with the result that two "blows" occurred within a few days of each other. No serious damage resulted, but it was deemed advisable to drive down all the front piling to increased depths before resuming excavation and to restrict the head on the dam by pumping out at low water only until a foreshore had been built up outside the piling. This naturally caused considerable delay in both excavation and timbering.

Two further small blows occurred in the West cross piling of this dam and a heavy leak developed through the old quay wall, the water entering through and under the wall to the Westward and entering the back of the dam. This was cured by dumping clay in front of the wall and excavation to a good foundation at the required depth was eventually completed in December, 1942, six months after construction of the dam had been commenced. Construction of the quay wall was carried out exactly as in the first section and was completed without incident at the beginning of April, 1943.

Following the suspension of pumping, severe subsidence occurred in the old wall behind the dam, probably due to the action of the tide, and to check this the space between the old and new walls was packed with hard filling as soon as the back walings were removed. In spite of this the back piling was extracted without serious difficulty. The extraction of all the piling, back and front, occupied just over 5 weeks.

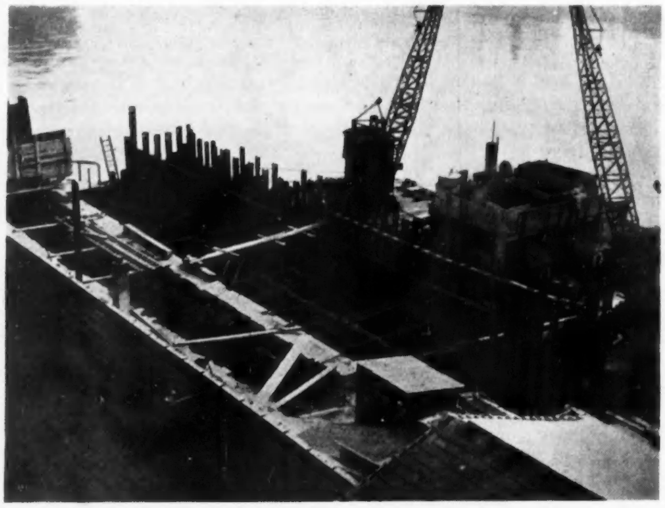
Work was immediately started on construction of the third dam and piling was completed in seven weeks, the ground being again very hard. No trouble was experienced until excavation had been carried down to within about four feet of foundation



Driving front piling for first cofferdam West of Dock Entrance. Back piling in place in front of old wall. Old wharf demolished.

Port of Dublin—continued

level, when a very severe blow occurred. Following this, all the piles were driven to increased penetration, involving a delay of 10 days, but shortly after excavation had been resumed a further severe blow occurred under the foundation of the old wall to the West of the dam. This caused heavy local subsidence and carried a large quantity of filling into the dam.



First (Eastern) Cofferdam closed. Old Transit Shed partly demolished.

To remedy this, a further section of the old wharf had to be demolished, sheet piling driven in front of the old wall and packed with clay, the bottom of the old wall inside the dam underpinned, the cavity behind it filled and the West end of the old shed behind the wall underpinned. This caused a delay of over three weeks. On resuming excavation it was found that owing to the flooding of the dam, the ground behind it had become loose and it was unsafe to continue working below the exposed toes of the back piles. These had been so badly distorted that they could not safely be driven further and it was, therefore, necessary to put down short lengths of piling in front of them to retain the ground. These were wedged off the back walings, but before some of them could be put in it was necessary to burn off the ragged ends of the back piles. Owing to this difficulty, a further fortnight was required to complete the excavation.

Concreting of the first section of the foundation had just been completed when a vessel swinging in the river rammed and sank the *Mudfisher*, putting out of action the cranes and concrete mixer. Fortunately the dredger foundered on the foreshore and, her deck being uncovered at low spring tides, it was possible to pump out and refloat her two days later, after the leaks had been caulked by the diver. This operation was not simplified by the fact that both the available salvage pumps were in the cofferdam and inaccessible owing to the position of the wreck.

It was, however, necessary to dry dock the dredger for repairs and open up the boiler and all machinery, so that it was seven weeks before she was again available. Meanwhile, in view of the very precarious situation of the work a steam crane was mounted on a barge and sent to the site, as soon as the wreck had been removed, and a special allocation of petrol for a concrete mixer was obtained.

Concrete had to be placed by barrows and chutes, taking nearly twice as long as by the usual method. The reach of the crane being insufficient to command both the foundation and the mixing site, it was used for the final cleaning up of the excavation and for placing and removing timbers. As soon as the wall had been concreted to a height of 9 feet above foundation and the space behind it packed with filling, the dam was considered safe and work was suspended until the *Mudfisher* returned. The remainder of the construction of this section was, fortunately, normal, except that heavy settlement took place behind the old wall after the dam was allowed to flood. This, however, was expected and led to no serious consequences. At this point rationing of electric power led to further delay in the demolition of the old wall and recovery of granite facing stones.

In the fourth cofferdam it was decided to stop excavating at a level of about 15 feet below L.W.O.S.T. and re-drive all front piling before excavating to final level, as it was concluded from previous experience that the skin friction on the piles in the hard boulder clay was too great to prevent their being fully driven until some of the ground had been excavated. This proved entirely successful and no blows occurred, though some delay was, of course, incurred. There was, however, no disturbance of the ground and no soil was carried into the dam, the flooding being controlled.

The only difficulty encountered in this dam was persistent leakage through the old wall, which was only partly checked by sheet piling and clay and by pointing open joints as far as the entrance to George's Dock. This caused some slipping of the clay at the back of the dam and made it necessary to drive down the back piling, but no further trouble was experienced and excavation was completed in December, 1944, the wall being completed to coping level in April, 1945.

During the extraction of the piling of this dam the demolition of the last section of the old wharf was carried out and in June, 1945, the piling for the fifth cofferdam was commenced. Piling was completed by the end of July and timbering and excavation started at once. This work was interrupted when excavation had reached a depth of about 14 feet below L.W.O.S.T. in order to drive the piles down further, the toes of several being almost exposed. This precaution prevented any "blows" occurring, the only difficulty experienced in this dam being in dealing with the inflow from a large low level intercepting sewer from the Custom House Docks area. This was got over by constructing an intercepting tank in the dam and placing the suction pipe of the

First section of Quay and Shed completed. Part of Old Shed in foreground.

4-in. pump in this. Excavation and construction were completed without difficulty by March, 1946, and the cross wall connecting the new and old walls was then constructed. This was of mass concrete without granite facing and incorporated a large culvert extending the sewer outfall to the Westward and providing access to the tide gates on the sewer. As it was not intended to deepen the dock entrance, the new wall was constructed only to a point 17 feet East of the entrance and no steps were taken to underpin the old wall West of this point.

On removal of the cofferdam, timber fendering was constructed at the West end of the new quay to assist vessels entering and leaving the dock. This was quadrant shaped and consisted of five Greenheart piles about 15 inches square heavily braced at the

top and at a level of 5 feet above L.W.O.S.T., provided with rubbing pieces and decked with 6-inch Greenheart planks. The piles were driven to depths varying from 15 to 20 feet below L.W.O.S.T.

Including this fendering, the total length of quay dealt with was 573 feet. During the whole period of construction there were constant difficulties with supplies of practically all materials, fuel probably giving most trouble owing to impossibility of carrying on the work without steam for cranes and piling and extracting gear. There were also the inevitable mechanical break-downs, most of which, though comparatively trivial, caused considerable delay owing to the impossibility of obtaining spare parts, which usually had to be made specially. A good deal of trouble was experienced with the pumps, owing to the fact that they were required to pump what was often practically liquid mud, a duty for which they were not designed. In spite of this, it was very seldom that work was seriously interrupted owing to pump failures.

At each end of the new quay, a specially designed and locally made mooring bollard was provided, arranged so that moorings of one vessel could be let go without interfering with those of another vessel made fast to the same bollard. This consisted of two cast iron cylinders, 15-in. diameter, set in the concrete wall, filled with concrete and reinforced, with a 5-inch diameter wrought iron cross bar passing through both uprights and projecting on either side.

On the remainder of the quay, double mooring hooks were provided every 50 feet approximately, being secured into concrete anchor blocks cast with the quay wall. Most of these hooks were salvaged from the old wall and reconditioned, but a few new ones were available, having been purchased for another work, and late in 1946 it was found possible to purchase some new hooks to complete the equipment. A number of Greenheart fenders, flush with the face of the wall but projecting about 6 feet above the coping were also provided to prevent the beltings of coasting steamers oversailing the wall at high tide. These fenders were fitted in recesses and secured by cross bolts fitting into special slotted lewises so that they could be readily renewed if necessary. Safety ladders were also provided at intervals.

As the construction of the quay wall proceeded the work of completing the new berths was put in hand. This consisted first of filling the space behind the new wall as soon as all piling and timbering had been removed and as much granite as possible recovered from the face of the old wall. The filling used was mainly dredged gravel, mixed with a certain amount of old masonry and excavated boulder clay and this consolidated satisfactorily and quickly, aided by a certain amount of tidal action, there being always some flow under the old wall, while drain pipes through the new wall were left open until the filling had reached a convenient level for the construction of connecting drains and manholes. Gravel filling was brought alongside in barges and placed by grabs.

Transit Shed

The next step, during the consolidation of the filling, was the building of the new transit shed. This was of reinforced concrete construction, 480-ft. 8-in. long and 31-ft. wide overall, with a height of 18-ft. to the underside of the roof slab. The main framework consisted of three rows of 16-inch reinforced concrete columns, octagonal in section, at 20-ft. 8-in. and 21-ft. centres in alternate bays longitudinally and 14-ft. 10-in. centres transversely. These columns were reinforced with six vertical bars $\frac{3}{4}$-in. diameter, held in position by spacing rings 2-ft. 6-in. apart and with $\frac{1}{4}$-in. diameter helical reinforcement at $1\frac{3}{4}$-in. pitch. The columns nearest to the river rested on the old quay wall, the central row being carried on mass concrete foundations 7 feet deep and 8 feet by 6 feet in plan, and the inshore row on similar foundations 7 feet deep and 6 feet by 4 feet in plan. Sufficient time was allowed for subsidence in the old wall to cease before erection of the shed was commenced.

The main transverse beams were 2-ft. 4-in. deep and 2-ft. 4-in. wide, with haunching over the column heads and were cast integrally with the five longitudinal beams. Main beams were rectangular in section, instead of the usual T-section, a space being left between the top of the beam and the underside of the roof slab, thereby ensuring the transmission of all loading by the longitudinal beams. They were reinforced with 1-in. and $\frac{3}{4}$-in. bars and $\frac{3}{8}$-in. stirrups.

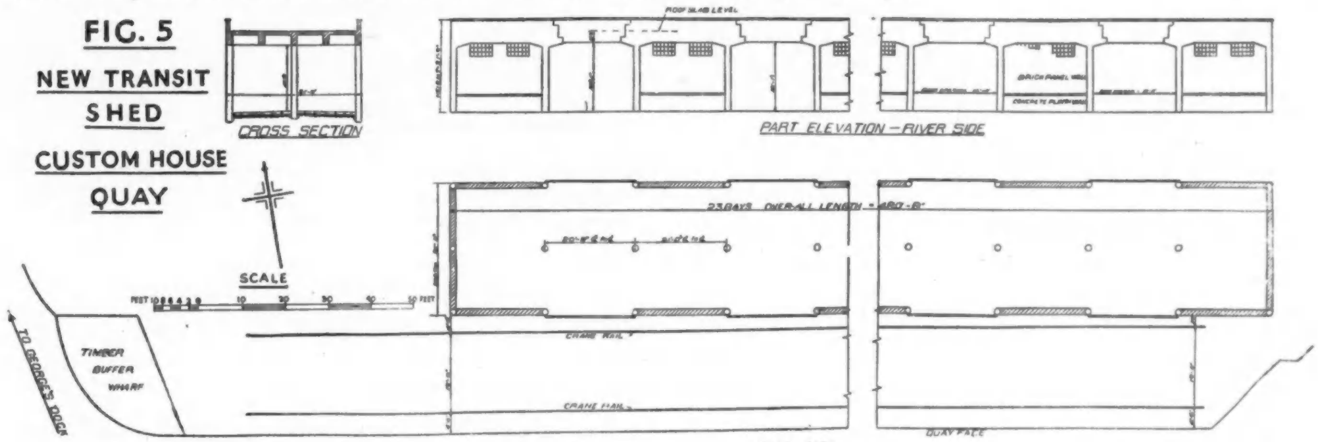


FIG. 5
NEW TRANSIT SHED
CUSTOM HOUSE QUAY

The longitudinal beams were five in number, the outside beams being 15 inches wide and the internal beams 17 inches wide, all having a depth of 25 inches below the 8-inch roof slab, with which they were cast. They were also reinforced with 1-in. and $\frac{3}{4}$-in. bars and $\frac{3}{8}$-in. stirrups, the roof slab being reinforced in one direction only with $\frac{1}{2}$-in. square bars, normally at 12-in. centres, but at 6-in. centres over beams. The minimum clearance under beams was fixed at 16 feet to permit the use of mobile cranes in the shed. There is a camber of 2 inches in the roof slab for drainage.

The amount of timber available was only sufficient to provide casing and centring for one 21-foot bay of the shed and the method of construction was to cast as one unit a group of six columns and the corresponding beams and roof slab, leaving the ends of the longitudinal beams cantilevered out for 3 feet and stepped, then similarly to cast the next bay but one and finally to cast the intervening bay as a suspended span. There were thus 12 fixed and 11 suspended spans in the shed, expansion joints being provided at each junction. The general arrangements of the shed is shown on Fig. 5.

The reinforcement used consisted of whatever bars were available from stocks originally purchased for other works, and was consequently not necessarily the most convenient, the helical reinforcement for the columns being practically the only new material used. The flat roof was designed for a live loading of 336 lbs. per square foot, on the assumption that when cranes became available it would be used for landing heavy cargo. It is covered with two coat asphalt, 1-in. thick, laid with a fall to each side to formed asphalt lined gutters, which discharge at intervals through openings in the surrounding reinforced concrete parapet wall. The composition of the asphalt required careful consideration, as it had to be capable of standing up to hard wear, while at the

Port of Dublin—continued

same time retaining the flexibility and weatherproof qualities of a roofing asphalt.

Asphalt was, of course, unobtainable during most of the period of construction, and it was not till 1946 that the first asphalt was laid. This was specified to have a penetration of 24 to 26 and has, so far, proved very satisfactory as far as freedom from leakage is concerned, but has not yet been tested under heavy loads, as no cranes are yet available.

Each fixed span of the shed was completed by the construction of panel walls, consisting of mass concrete 15-in. thick for a height of 4 feet above ground with a 11½-in. brick cavity wall from that level to the soffits of the outer longitudinal beams. Four steel-framed windows are provided in each bay.

The openings in the suspended spans were left as doorways for the full width between columns, except in two cases where, owing to the impossibility of getting timber for doors, they were temporarily built up with concrete cavity blocks in lime mortar.

Double sliding doors, each 16-ft. 6-in. high and 10-ft. 2-in. wide with 4-inch framing, are fitted at each opening. Most of them are carried on No. 4 Coburn overhead track, but owing to the very long delay in obtaining this the doors in the first part are carried by cast iron rollers running on overhead angle iron guides, this gear being made in the Port and Docks Board's workshops, like most of the other special requirements.

The floor of the shed is of reinforced concrete, 6 inches thick, laid with a fall of 3-in. from the centre line of the shed to the river side and 6-in. to the gutter on the road side. The shed is divided into three compartments by transverse walls of concrete blocks. Access to the roof is provided by a reinforced concrete staircase at the Western end.

Work on the shed was not commenced until October, 1942, four months after the first section of the quay wall had been completed, and the first section was not concreted until February, 1943. The rate of progress was dictated by the rate of construction of the quay wall and was consequently low. At one period it was necessary to omit several bays of the shed in order to avoid interfering with the last section of the old shed, which housed the machinery for the quay deepening.

Equipment

The width between the shed and the face of the quay is 26 feet and this is surfaced with 7-in. reinforced concrete with a fall of 5 inches to the quay. Immediately behind the coping, 4-ft. 6-in. from the face of the quay, is laid a 75-lb. flat bottomed rail for portal cranes. This rail is carried on the quay wall. The second rail, 2-ft. 6-in. from the wall of the shed, is carried on a continuous concrete foundation.

Immediately behind the quay side rail there are three 4-in. concrete pipes containing the lighting cable and the two single-core power cables for the cranes. These cables are looped into cast iron plug boxes every 80 feet, each plug box being surmounted by a lamp standard. On the inshore side of these is a water main with hydrants for fire fighting and supplying water to ships.

The cranes, which are on order but have not yet been delivered, will be of 4-ton capacity, level luffing, with a working radius of 55 feet and capable of hoisting to 65 feet above quay level. They will, therefore, be capable not only of landing cargo on the roof of the shed, but also of loading direct on to vehicles on the inshore side of the shed. The power supply, which is direct current at 500 volts in order to standardise with cranes elsewhere in the port, will be provided by a rectifier sub-station now under construction at the East end of the new shed. It is intended to instal cranes also on the Western section of the new quay and they will be supplied by submarine cables laid across the dock entrance. No steps have yet been taken to instal conveyors, but the preliminary scheme is for a belt or roller conveyor running the full length of the shed and feeding one or more similar conveyors carried on gantries across the roadway to the adjoining warehouses.

Construction (Western Section)

Work on the West side of the dock entrance did not commence until April, 1947, for several reasons. First, the rapid recovery of trade in the port made it undesirable to take over any further sheds for demolition until the new sheds under construction were ready for use. Secondly, it was found quite impossible to dredge the new berths to the required depth with anything except the heavy digging grabs carried on the *Mudfisher*, owing to the extreme hardness of the ground, with the result that this vessel was not available for piling. Thirdly, the steel piles which had been used for five cofferdams and many of which were not new to start with had been so badly damaged that they were scarcely fit for re-driving. It was decided, therefore, to suspend the work until new piles could be obtained.

The general scheme for the Western section of the quay is very similar to that described, except that opposite the Custom House the new wall will be built approximately on the line of the old one instead of in front of it, while the length of the new shed will be limited by the restriction on building closer to the Custom House than the end of the existing shed. The first section of the wall has been founded entirely on limestone rock, which was found at levels between 11 and 14 feet below L.W.O.S.T., the beds dipping sharply in a South-Easterly direction.

The broken and weathered rock was removed and a trench cut along the front of the foundation to a level of about 16 feet 6 inches below L.W.O.S.T., the remainder of the foundation being cleaned off at a general level of about 15 feet below L.W.O.S.T. The very rough and irregular surface of the rock provided such an excellent key that it was considered unnecessary to excavate the whole foundation below the final level of the new berth. It was, of course, impossible to drive the sheet piling down to foundation level, but the usual precaution of re-driving after excavation had been extended to within a short distance of the pile toes enabled most of the piles to be driven down to the top of the rock. With the formation of a substantial clay foreshore outside the dam, this proved successful in preventing blows and as the use of new piles eliminated the trouble previously experienced with leakage through the butt joints of the piles, the only appreciable leakage was through the old wall. This was at one time fairly heavy, but the driving of sheet piling to the West of the dam and dumping of a clay blanket between it and the wall reduced the leakage to reasonably small proportions.

Rock breaking will be required to deepen the new berth, but this will not be undertaken until after the removal of the cofferdam. It is probable also that a modified form of wall will be adopted where the level of the rock is higher than in the present section. Reinforcing bars being now available a reinforced cantilever wall may well prove more economical in view of the high cost of cement.

It is regretted that no detailed costs are available. The original estimated cost, including all operations, was £75 per lineal foot of quay, but this has naturally been very substantially exceeded owing to the great increases in the cost of labour and materials. The difficult circumstances in which the work was carried out also contributed to the extra cost, which has amounted to rather more than 100 per cent. of the original estimate.

The orginal estimate for the shed was £22 per foot run and the cost of completing the first shed is expected to work out at approximately £45 per foot run. Even this high figure, however, compares favourably with the cost of a shed of similar construction built two years ago by competitive tender.

(To be continued)

Improvements at the Port of Genoa.

It is reported that an ambitious two-year project for the development of cargo-handling and transportation facilities at the Port of Genoa is being prepared by a permanent Italo-Swiss Committee. About 30,000 workers will be employed on the scheme which is estimated to cost about £12,500,000 and will be largely financed by a Swiss syndicate. Rail transport and other facilities are to be rebuilt and extended in order to increase tourist and commercial traffic. Switzerland is greatly interested in better facilities for transport via Genoa which has now become her main port of transit.

The Future of British Ports and Canals

At a meeting of the Institute of Transport, held on the 12th April last, a paper with the above title was read by Mr. W. A. Flere, who is a member of the River Department of the Port of London Authority. The author examined the development of our ports, the present system, and possible administration under the British Transport Commission, including a suggested grouping of ports.

After outlining the history and growth of British ports and canals, Mr. Flere stated that the development of the British ports up to the day of being taken over by the Docks and Inland Waterways Executive of the British Transport Commission had been haphazard, with no plan or scheme behind it. The problem now facing the Commission was how to co-ordinate the various forms of transport so as to secure the fullest advantage from each in the national interest.

Present Position

An examination of the Commission's field as regards British ports, reveals, he said, that there are about 350 places in Britain, each a geographical entity, that could be called a harbour or a port, using the criteria of:

(a) Possession of the shelter and equipment necessary to discharge or load goods or raw materials.
(b) Local customs or revenue supervision.
(c) A separate approach, whether artificial or not, from the sea or the main river channel.

Wharves and lay-byes, customarily considered as part of a larger port installation or abutting thereon, are not included in the figure of 350.

Over 50 of the smaller ports are privately owned (many by individuals) and about 45 of these are run exclusively as adjuncts to private estates, or for the sole use of a company handling locally obtained mineral or other products. Certain Scottish ports handling granite, Welsh ports handling slate, etc., are examples. Only one or two can deal with a ship of over 1,000 gross registered tonnage and most may fairly be said to be interesting relics kept alive and in working order solely because the trader or estate finds it convenient to have a separate installation. About 20 of the total number of 350 are predominantly fishery ports, although coal, stone and other goods are also handled.

These places cannot be called "trade harbours," since the business of a general wharfinger is not customarily engaged in, nor in most cases is there competition with other local ports. The customs authorities can see to it that only certain classes of goods can be dealt with at them, by withholding permission for anything but low category goods.

A rough estimate, based on the advertised deepest draft or gross registered tonnage of the largest vessel that has used the particular port or harbour, reveals that about 140 of the total of 350 mentioned can accommodate only vessels up to 500 tons at alongside berths, whilst a further 80 or so can deal with vessels up to 1,000 tons only. This means that about two-thirds of the total number of ports in Britain can handle vessels of the smaller class of coaster up to 1,000 tons. Many of these ports are very old, and unless specially put in for dealing with a special trade, their equipment is either antiquated or non-existent.

If the liner coaster class is included, that is vessels between 1,000-2,000 tons gross, three-quarters of British ports can take no larger vessel alongside. Obviously, many of these vessels will have appropriated tidal berths in some of the larger and better served ports, and would not trouble with the smaller ports, but the figure is of interest, as showing what accommodation is available.

It has recently been computed that a coaster, whether on schedule service or tramping, only spends about a third of its time at full power at sea. Recent developments in design have tended towards larger vessels, since the small coasters are "heavy" ships (i.e., the ratio of their deadweight carrying capacity to displacement weight is about 0.5 as against 0.75 for an 8,000 gross ton freighter). In older vessels the steam-power plants accounted for much of this weight, and the increasing success of the Diesel drive in reducing displacement may be expected to continue. The Diesel ship represents a greatly increased capital cost, which makes a speedier turn-round in port essential. It is probable, therefore, that some of the smaller and less convenient coaster ports, unless kept open for local fishery traffic may have, with the recent changes in money values, to be closed, especially those with some physical disability, the amelioration of which makes their continued existence an expense out of all proportion to actual or potential traffic receipts.

In both England and Wales there is a clear case for investigation at any rate of the allegation that there are too many coaster ports. The recent Clyde Estuary Committee categorically stated that too much port accommodation was available in Great Britain for the quantity of pre-war trade passing. Presumably, by this they meant foreign trade.

There has been a steady increase in the size of ships and this affects the ports considerably. Just prior to the war of 1914-1918 the length of the largest tonnage class of ships was about 350-ft., having a gross tonnage of around 3,800. Just prior to the last war this length had increased to between 470 and 500-ft. Even the most prolifically produced general purpose class of vessel, the Liberty ship, has an average length of 420-430-ft. Typical drafts also have increased during the same period from 24-25-ft. to the 27-28-ft. of the Liberty ship with 28-29-ft. for the 500-ft. vessel. Overall increases in ship measurements, particularly length and beam, may be expected to continue, especially since cargoes appear to be increasing in cube but not in deadweight.

Port authorities then, as a result, are faced in the future with the task of dealing with a decreasing number of vessels, making more voyages a year and needing port accommodation for a shorter time than formerly. The increasing ship dimensions will cause their older accommodation to get out of date more rapidly, although of course for some trades the foreign terminal ports dictate ship dimensions at the present time.

Inland Waterways

Dealing with inland waterways, Mr. Flere said that the difficulty of obtaining wagons has diverted much of the lower grade import and export traffic from railways to water-borne or coaster transport. The comparative slowness of water transport is against its use in normal times except for bulk transport of low value materials. At the present time, the scarcity of rail transport has forced some of the higher class goods to move by water. No ground exists at the present time for regarding any inland waterway as obsolete unless it serves a worked-out mineral area or a dying industrial area that defies resuscitation, or has a grave physical disability such as lack of adequate water supply, etc.

The "Cross" scheme, put forward by the Royal Commission on the Canals and Inland Navigations of the United Kingdom in 1909, advocated the joining of the estuaries of the Humber, Thames, Severn and Mersey with the Midlands by waterways capable of taking 100-ton boats as a minimum. Although all the waterways to make up the "Cross" exist, yet for much of their length only vessels of 70-ft. long and 7-ft. beam or less can use them. This, coupled with their slowness, puts the canals at a great disadvantage in normal times when moving bulk freights from or to port. Self-propelled craft used for towing, and provision of the lighter high-speed Diesel engines are current developments, but the crux is the capital that must be spent on widening lengths of the "Cross" canals even to take vessels of 14-ft. beam.

The Transport Act, 1947

The taking over of the railways and the inland waterways was accomplished on January 1st last. The appropriate executives have provisionally divided the country into five areas in each case, and although these areas are not identical, they do suggest possible groupings for ports within the scheme since all forms of transport, including roads, will be considerably occupied in dealing with port traffic.

The Commission will no doubt have consultations with such bodies as the Coasting Control Committee, which licenses voyages for coasters, and with foreign-going shipowners through their various outward and homeward conferences. It should be possible by the use of selective rates and charges to secure some sort of planning, although it may take many years to re-orient local interests so that maximum economies are obtained.

Future of British Ports and Canals—continued

Suggested Port Groupings

Bearing in mind the changing sizes of industrial areas, Mr. Flere said that the following tentative suggestions for port groupings are suggested:—

(1) **Scottish Group.**—To include all ports and trade harbours on the Firths of Clyde and Forth, and the ports of Dundee and Aberdeen. The total population residing within 25 miles of each port is 3¾ millions, whilst for 40 miles the figure is over 4½ millions, or 90 per cent. of the total for Scotland.

(2) **North Eastern Area.**—To include all ports on the North East Coast from Scarborough to Berwick-on-Tweed, embracing the Hartlepools, Sunderland, Newcastle and Blyth. The total population residing within 40 miles of these ports is estimated to be nearly two millions.

(3) **Midland Area.**—To correspond roughly with the Northern and Eastern areas of the inland waterways organisation. All ports in the area from Bridlington on the East Coast and Silloth on the West to Boston on the Wash and Chester on the Dee. This would embrace Hull, Immingham, Preston, Goole, Liverpool, Birkenhead, Manchester and Barrow-in-Furness. An estimate of the total population served would be about 15 millions.

(4) **Eastern Area.**—This corresponds roughly with the Southern area of the inland waterways organisation. To include all ports on the East Coast from King's Lynn to Margate. The ports of Yarmouth, Ipswich, London, Rochester and Whitstable are the principal. The total population of the area is estimated at about 12 millions.

(5) **Western Area.**—To correspond with the Eastern part of the inland waterways area similarly named—all the ports on the Severn estuary from Gloucester to Hartland, including Sharpness, Bristol and Bridgwater. Immediate population about two millions, but would relieve Midland and Eastern areas.

(6) **Southern Area.**—To include all ports from Ramsgate to the estuary of the Exe, including the Isle of Wight. The ports of Dover, Shoreham, Southampton and Weymouth serve a primarily agricultural population, estimated at three millions and steadily increasing.

(7) **South Western Area.**—To include all ports from the estuary of the Exe to Hartland Point. Plymouth is a port of call and Penzance deals with flower and vegetable traffic from Scilly Isles. Total population served is estimated at a million.

(8) **Welsh Area.**—All the ports from Newport on the west bank of the Severn estuary to the west bank of the River Dee. Cardiff, Swansea and all the South Wales coal ports are included. Holyhead in Anglesey is especially mentioned in the Act for transfer to the Commission. The estimated population served is 2½ millions, the total for Wales.

Administration and Functions

For administration purposes, continued Mr. Flere, it may be that a local committee deputed from among members of the largest of the existing autonomous port trusts in each area would be set up under powers given the Commission by Section 70 (4a) to advise on the working and provision of port facilities in the areas. Broad policy would be laid down for them by the Commission, on the lines of fostering the trade of the larger and better-equipped ports in every way, paying great regard to possibilities of industrial developments in their area, and considering future port facilities in the light of first and subsequent maintenance costs of suggested improvements. Briefly, they would seek to help the better physically and industrially placed ports in every way, would seek to divert trade to them and away from the smaller and more expensively maintained ports, removing equipment therefrom if they were of opinion it could be put to better use elsewhere.

If the principle of organisation by areas is accepted, representations on general policy would be best done at headquarters. Technical direction on matters touching hydrographic surveying, wreck dispersal, dredging, provision of training banks, groynes, etc., such as was formerly given by Admiralty and Trinity House representatives, are better dealt with on a wider basis. A central technical committee with power to co-opt members of the local area staff with the necessary local knowledge could do all that was necessary to decide policy.

Research

Finally, power is given in the Act for the Commission to "do anything for the purpose of advancing the skill of the persons employed by them or the efficiency of their equipment or of the manner in which that equipment is operated, including the provision of facilities for training, education and research." There are many problems calling for research, particularly on the port engineering side. Ports are so costly and have such high annual maintenance charges (as the price of interfering with natural river and sea phenomena), overcoming tidal difficulties, etc., that a port research establishment is essential. The United States at Pittsburgh and Holland at the Hague, have long had State aided marine and hydraulic research departments. Great Britain has nothing of this sort, although over **£200,000** is the annual cost at each of its two leading ports on maintenance dredging alone. Research on port equipment such as cranes, etc., is better carried out by the industry, for any improvements as a result of their research efforts can be applied to individual designs. An engineering and hydraulic port research department should be set up at once to deal with the more pressing problems, and to conduct certain "long range" investigations.

Control of Coast Erosion

Mussel Beds an Effective Shield

By ERIC HARDY, F.Z.S.

The factors influencing the erosion of coast lines, particularly sand or clay coasts and river estuaries, are numerous; several of them are directly connected with the natural fauna and flora of the sea or estuary and the commercial exploitation of the same. The use of marram-grass and pine for stabilising coastal sand hills has already been described, and the effect of the cord-grass, *Spartina Townsendi* has been discussed at length (*The Dock and Harbour Authority*, December, 1940 and February, 1942). Where the problem of coast erosion is largely one of sand and sand hills several plants in addition to Marram grass have useful effects.

Three useful dune grasses with long roots to bind the sands and fix them include the Rushy Sea-Wheat, *Triticum junceum* (or *Agropyrum junceum*) a common native on sandy seashores of Britain and North Africa forming large masses of rigid, glaucous grey foliage growing from stout root stocks which creep extensively through the sand; the Upright Sea-Lyme-Grass (*Elymus arenarius*) a more northern grass, native to British sandy shores from Essex and North Wales northwards, and in Europe, North America and North Asia, with rigid, rather pungent glaucous leaves coming from stout, creeping root stocks; and perhaps best of all the common marram or star grass, *Psamma arenaria* (or Ammophila arundinacea), sometimes called "sea-reed," which inhabits the shores of Europe, North Africa, and Western Asia, where I have found it on the sandy coast of Palestine. The work of holding loose sand wind-blown into damp hollows to form new dunes is started in many places by the Shining-Fruited Rush (*Juncus lamprocarpus*) or its parent type the Jointed-Rush (*Juncus articulatus*) with its slender stem and leaves, and the coarse Fiorin bent grass (*Agrostis palustris*) all plants of the damp hollows between the dunes. After these grasses have held the sands, the creeping dwarf willow (*Salix repens*) secures a footing and rounded knolls of considerable size are formed.

After the primary work of the grasses, trees may be used to hold the sandy coast. These need not always be pines. The fragrant balsam popular (*Populus balsamifera*) may be seen upon the extensive sandy coast of west Lancashire, north of Liverpool, both planted and self-spread, covering a wide area by the many shoots it sends up. The Cluster Pine (*Pinus Pinaster*) also proves successful as in Norfolk at Westwick. At Holkham on the Norfolk Coast, remarkable success in preventing coast erosion has been obtained by planting Austrian pine in the exposed parts and Corsican pine in the sheltered parts, the use of larch and maritime pine proving less successful. After the initial protective belt these pines established themselves by natural regeneration. Where the marram grass has spread to the edge of the dunes, self-sown pine trees come up almost at the beach. The cluster pine has been largely used on European coasts, as well as those of the Mediterranean, Northern India, Australia, New Zealand, China and Japan, to bind the sand with its roots. Near Bordeaux on the French Coast it has been sown extensively and with high success

Control of Coast Erosion—continued

to fix the shifting dunes between the Adour and the Gironde Rivers, hence its nicknames of *Pin de Bordeaux* and *Pin des Landes*. The West Lancashire sand hills north of Liverpool, treeless in 1887, have been fixed by an afforestation mainly of Corsican pines with a few Austrian pines, the Scots pine proving a failure. Canadian poplar, Abele, birch and alder have also been used to a small degree. On the coast of Palestine I noticed the Government of the country is making extensive plantings of Tamarisk, several thousand acres, near Gaza, to hold the wind-blown sands from the Sinai desert. I have seen both the date-palm and the dumdum palm playing a minor part in holding sands on the North African Coast.

The animal population on and offshore also bears some considerable influence upon the erosion of soft coastlines. Extensive burrowing by rabbits often weakens the effects of the sand-grasses and the control of these rodents should be pursued in the winter months before the breeding season begins early in the Spring. Shelddücks, very common nesters in burrows along sandy coasts, are harmless because they only occupy the rabbit-burrows already made there.

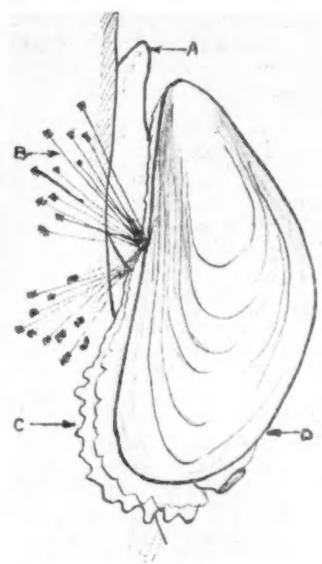
Date Palms help hold the sands along the coasts of North Africa and the Levant.

Offshore the strength and direction of coastal currents are influenced considerably by changes in the stability of sand and mud-banks, and by the shielding effect of large mussel beds. The effect of a big mussel bed upon protecting coastlines from sea erosion is not always fully appreciated and if during the present food shortage these mussel beds are over-exploited as to reduce their size, coast erosion will follow in many areas. A large mussel community, as exists in many river estuaries in America and Europe, plays a valuable part in protecting the coast from inundation by the sea currents. A good bed of sea-mussels forms a protective crust which reduces the eroding action of the waves and tends towards the building up of an inter-tidal zone which encourages an even thicker and denser mat of mussels to form. Even the partial removal of mussel clumps from such beds may be followed almost immediately by changes in the topography of the shore line. Commercial operations therefore need to be watched in order that they do not exceed a certain point. Many mussel beds in estuaries like the Lancashire Ribble and Lune, closed for human fisheries because of pollution by sewage, nevertheless continue to function as important controls upon coast erosion. These mats of sea-mussel will extend down to mean low water level, and they grow several feet below water level in some places where star fish, whelks and sea-urchins, which prey upon them, are not common.

The Cranbrook Institute of Science, Michigan, has recently issued some interesting studies by its staff zoologist on this problem in the Bay of Fundy, where the starfish population and the predatory blue crabs are an effective influence in checking the size of the mussel bed. In British waters mussel beds are fed upon extensively in winter by sea duck, like the scoter and the scaup, but without any serious effects.

The interesting point is that although mussel clumps appear to be quite extensive over a salt marsh, careful examination shows that less than 1% of the surface of the marsh is actually populated with mussels. Various factors limit the size of the mussel bed, factors like the chemical changes in the sea water, predatory animals like star fish, and the accumulation of mud and silt, in addition there is the normal rate of growth in relation to the age of the mussel bed, which is many times the life-span of the individual mussel. In large areas of the mid-Atlantic coast of America the population of predatory crabs and star fish feeding on the mussels often makes mussel beds a success or a failure according to their own numbers. It takes more than two-and-a-half-years to establish to full development a community of the common sea mussel. Much depends upon the survival of the early free-swimming stage which seeks suitable ground for settling down to the adult sedentary life. A single sea-mussel lays more than 12,000,000 eggs a year, and these measure only 0.07 mm. in diameter.

This period required for a mussel community to reach maturity should determine the degree of commercial exploitation permitted. The young mussel attaches itself by adhesive silken threads, the "byssus," which withstand most of the storms; but mussel beds, like oyster beds, are not inexhaustible. The French have long mastered the art of artificial mussel-bed culture in places like the mud flats of the Bay of Aiguillon, near Rochelle, at Charron, Marsily and Esnades. This they accomplished by driving piles into the mud flats until 5 or 6-ft. remained above the mud. The piles were placed in long rows converging out to the sea and between the piles wicker-work was entwined. Here the mussel spat attached itself in February and March, usually to individual posts from which they were transplanted to the lowest parts of the palisades. At other places the mussels are encouraged to grow upon sticks sunk into sandy shores.



The common estuary mussel attaches itself firmly and resists erosion by increasing bank-level. A—"Foot." B—Byssus or threads that cement its attachment. C—Mantle. D—Growing part of shell.

The sea mussels on some parts of the Californian coast grow to 9-in. in length, while the fan mussel grows to twice this length, but it has not such an extensive distribution as the common edible sea-mussel. The latter had not only such a wide distribution in both European and American waters, but inhabits salt, brackish and freshwaters. On British coasts the heaviest settling of mussels appears to take place from July to October. The mussel bed raises the level of the sea floor slightly by holding mud and sand in a stable bank and so reduces the strength of currents flowing over it against the soft coastline. In a river estuary, of course, erosion of banks may also be brought about by structural alterations which interfere with the current. The steady erosion of the soft clay cliffs of South Lancashire, in the Mersey above Liverpool, is said to have arisen after the building of the Manchester Ship Canal embankment, on the opposite shore.

Soft rock along the coast are frequently bored by date shells (a type of mussel) and the pholas shell (a relative of the ship-worm) but without any appreciable effect upon erosion. Cockle beds seem to have only a very limited or negligible effect upon checking erosion even though some beds extend for upwards of 320 acres at South Wales. The cockle buries itself in the sand rather than just attaching itself like the mussel.

On American and other coasts clams will also have a certain check on coast erosion although not to the same effect as large mussel beds. The problem of clam-farming has been studied closely by the Atlantic Biological Station of the Fisheries Research Board of Canada in recent months, with useful results. New England has likewise propagated clams. They have shown how over-fishing has brought about the depletion of many beds. Small clams or "seed," $1\frac{1}{4}$-in.-$1\frac{1}{4}$-in. long, are transported from overcrowded areas where they cannot mature properly, to good growing and maturing grounds. Extensive tidal flats are in some places crowded with 100 or more clams per sq. ft.

Control of Coast Erosion—continued

In New England clam "seeds" are dropped 3-in. apart like potatoes in furrows, 4-in. to 5-in. apart in the shore, made by a hand plough; and covered by the ploughing of the next furrow. Off Canada they are broadcast by hand from the beach at low tide or from a boat at flood tide, at the average rate of 8-10 bushels per hour; 200 bushels are sown to the acre, in calm weather and little currents. But the clams bury themselves in the ground more than do the mussels. Three or four years are required for them to mature to $2\frac{1}{4}$-in. long. However, there is a 25% loss of stock at planting, and subsequently an annual loss of 2% to 10%, so that in a good area only 70% survive after four years. Many clams are killed in severe winters by smothering under ice on the beach, and others by the attacks of the smooth whelk. Good growing grounds are not generally found near the heads of harbours or in small coves with narrow outlets. Growth is best at or near low water mark and poor at high levels on the beach. Sandy soils are best for planting, but loose, coarse shifting sand is unfavourable and gravel-mud combinations, are often unsatisfactory.

Severe winters, like that in 1947, have a very destructive effect upon mussels, clams, cockles and other inshore shell fish; there is a high mortality when, at low tide, they are exposed to several degrees of frost. Great gales which pile up the beach with heaps of young shell fish are also very destructive to beds. Oyster beds are more effective than clams, but generally not common enough off the coasts to have such an important position as their poor relation, the common mussel.

There is finally the effect of submerged forests to consider. Some two thousand years ago much of the coastline that is now sandy, like that of Lancashire and Cheshire, parts of North Wales, South Wales, etc., were afforested. Even the bulk of the Sahara Desert of North Africa is wind-blown sand that has conquered the former forest land. These forests of oak, willow, hazel, etc., around the British coast prevented a great deal of coast erosion until there occurred cases of subsidence of the land when the sea inundated and killed the forest and wind-blown sand accumulated. Relics of these submerged forests exist on parts of the coast in the form of peat beds exposed on the sands, and in them are the stumps of the trees. There are samples of this to be seen on the coast north of Liverpool, at Hall Road, Crosby. But as these are not living plants, increasing and extending their roots like the mangrove swamps of tropical shores, their value has long been a declining one. The sea gradually disintegrates the peat from around the stumps and winter gales wash out the logs and stumps of what is known as bog oak or black oak. The peat forest at Dove Point, Meols, on the Cheshire Coast, has been washed away almost entirely in the present century. Some of this subsidence must have occurred in historical times, particularly on the Mersey Estuary shores, because the history of Stanlow Abbey, whose ruins now stand on the point isolated by the Ship Canal opposite Ellesmere Point, reveal that owing to a "dreadful inundation" in 1279 the monks had to vacate the abbey.

I have not taken into consideration in this article the numerous mechanical influences upon coast erosion, particularly where currents erode the coast at one part and deposit the erosion at another, as may be witnessed on the Lancashire Coast south and north of Formby Point.

Obituary

Ralph Frederick Hindmarsh

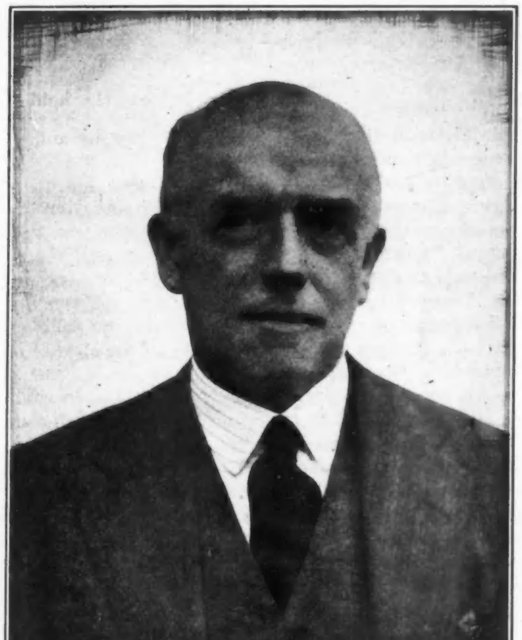
It is with regret we have to record the death on 16th March last of Mr. Ralph Frederick Hindmarsh, who retired from the position of chief engineer of the Tyne Improvement Commission in February, 1947, after more than 50 years service.

Mr. Hindmarsh was born in 1877 and was educated at the Royal Grammar School, Newcastle-upon-Tyne. In 1892, he commenced his engineering training with the late Mr. Alfred Stephen Dinning, a Newcastle civil engineer, with whom he remained until 1898. During that year he entered the service of the Tyne Improvement Commission as assistant engineer to the late Mr. James Walker, M.I.C.E., and for the next four years he was engaged on works connected with the regulation of the River Tyne, the building of river walls at Blaydon and Newburn, and dredging at the mouth of the river in connection with the Shields ferry improvement scheme. In 1902, he became principal engineering assistant to Mr. James Walker and worked in the main offices of the Commission in Newcastle. From 1903 until 1909, he acted as resident engineer in connection with the Tyne pier works, and was then appointed chief assistant engineer to the Commission, until January, 1915, when he was appointed chief engineer.

Mr. Hindmarsh's period of service included two major wars, during each of which the river became an important Admiralty port, and his experience was of great value. During his long term of office many additions were made to the facilities of the Tyne. Among them were the Albert Edward dock and the Tyne Commission quay and extension. At Tyne dock there were constructed the Southerland and north-west quays. New coal staithes were built at Howden and Jarrow. An important improvement was the provision of deep-water berths at Jarrow Slake, the swinging area at Tyne Main and the removal of Felling Point. Other improvements at Jarrow included the oil jetty and timber quay and the reorganisation of Tyne dock after it was taken over by the Commission in 1937. A new quay was built at Wallsend, and the Commissioners' engineering yard at Howden was fully modernised. Between the two wars Mr. Hindmarsh prepared and carried through a plan for the clearing of derelict sites on the river banks. Details of this improvement were published in the September and October, 1938, issues of this Journal.

Mr. Hindmarsh was a member of the Institution of Civil Engineers and served on the Council. He was also a member of the Committee of the Alfred Yarrow Educational Fund; was a co-opted member of the Post-War National Development Committee; and a member of the Permanent International Association of Navigation Congresses.

He presented a number of papers before the Institution and other bodies, and three times was elected Chairman of the Newcastle Association of the Institution of Civil Engineers. In 1922



The Late R. F. HINDMARSH.

he gave an address on "Water and Tidal Power." In 1923 and 1924 he gave two Vernon-Harcourt Lectures, taking as his subject river improvement and tidal rivers and estuaries. His paper on "The Tyne Commission Quay, North Shields," of 1930, gained for him the Telford Premium. Other subjects upon which he wrote and spoke included the design of harbours and breakwaters, Tyne bridges, lighthouses, coast lighting and methods of coal loading for the export trade.

PORT OPERATION

Part 17 of a Series of Articles by A. H. J. Bown, M.Inst.T., A.C.I.S., and Lt.-Col. C. A. Dove, M.B.E., M.Inst.T.

(Continued from page 325)

1. SAFETY MEASURES AND HYGIENE

In connection with port operation, the term " safety measures " is most commonly understood to relate to safe working conditions for all persons employed or having business within port areas. In its wider sense, the term extends to cover more than this; for the efficient port operator strives to create completely accident-proof conditions so that, besides preserving the work people from injury, disease and sudden death, he also hopes to avoid accidents to ships, cranes, locomotives, coal-shipping appliances, motor vehicles and all other plant as well as to prevent damage to his roads, railways, sheds, lock gates, entrances, bridges and quay faces. One human life is worth more than all the mechanical appliances put together, but if taking care of the appliances and using them sensibly means also fewer accidents to human beings then a double benefit is secured.

The Principal Considerations

It is not possible, within the scope of this brief summary, to deal exhaustively with the important subject of safe working in ports, but it may be helpful to set out first, a short list of the chief points and then follow with a note on each of them. The following list may be useful for this purpose:—

- The Docks Regulations (1934)
- The Factories' Act, 1937
- Health, Safety and Welfare
- Fencing
- Transmission machinery
- Protection of eyes
- Hoists or lifts
- The Shipbuilding Regulations, 1931
- The Building (Amendment) Regulations, 1931
- Safety Organisation in Docks Industry
- Accidents to young workers
- The Petroleum Acts, 1871 and 1879
- Disinfestation of Grain Warehouses
- The Inspection of Imported Food by Port Health Authorities
- Dock railways—safety precautions
- The Electricity Regulations

Docks Regulations, 1934

These Regulations were made by the Secretary of State under Section 79 of the Factory and Workshop Act, 1901. This Act was followed by other legislation, culminating in the Factories' Act, 1937, which was a consolidation, amendment and extending Act.

Part I of the Regulations requires the safe maintenance of approaches used by workpeople over docks, wharves and quays; the fencing of dangerous parts or edges and especially of footways over bridges, caissons and dock gates; the provision of adequate life-saving appliances and of means of support or escape for persons who may fall into the water; efficient lighting; a sufficient number of properly-stocked first-aid boxes or cupboards (the person in charge to be trained in first-aid where over 50 persons are employed); an ambulance where more than 50 persons are employed unless there is an ambulance, within two miles, available by telephone; and the exhibition of notices regarding the position of first-aid boxes, stretchers and the ambulance.

Part II of the Regulations lays down the requirements for safe working in respect of ladders and gangways between ship and shore; the means of access from one ship to another moored alongside; ladders between deck level and the bottoms of holds; hand-holds and footholds across shaft tunnels; the adequate lighting of holds and other parts of cargo-working ships; and also the design, clear marking and handling of hatch beams and hatch coverings.

Part III, together with the Schedule attached to the Regulations, is concerned with lifting machinery—cranes, derricks, bridle chains, rings, hooks, shackles, swivels, pulley blocks and winches. The Schedule lays down the manner of test and examination before taking lifting machinery and gear into use; cranes, derricks and winches with a safe working load up to 20 tons must be tested with a proof load 25 per cent. in excess; 20 to 50 tons, 5 tons in excess; and over 20 tons, 10 per cent. in excess. Chains, rings, hooks, shackles and swivels must be proved for twice the safe working load, single-sheave blocks, four times; multiple sheave blocks up to 20 tons, twice; over 20 tons and up to 40 tons, 20 tons in excess; over 40 tons, one-and-a-half times the safe working load. The Chief Inspector of Factories may grant certificates of exemption upon stated conditions. The safe working load of wire ropes is one-fifth of the breaking load as ascertained by a test to destruction. Derricks must be inspected every twelve months and thoroughly examined once every four years. All other lifting machinery must be thoroughly examined once every year. Requirements for annealing chains and other small gear are also stipulated—half-inch and smaller chains, every six months; others, once a year; but the Chief Inspector may, by certificate, give exemptions. All chains and other small gear must be inspected by a competent person on each occasion before use in hoisting or lowering unless they have been inspected within the preceding three months. After welding and before being used again, all chains and small gear must be adequately tested and re-examined. The initial proving of wire rope has been mentioned above, and any other rope, before use in hoisting or lowering, must be of suitable quality and free from patent defect. Wire rope requires inspection every three months, and every month after one strand has broken. Requirements are also laid down to prevent the use of badly-worn ropes and to control the style of splicing. The Chief Inspector may rule (subject to appeal) that a particular person is not competent to carry out tests, examinations or annealing. The safe working load must be stamped on pulley blocks and marked on cranes, derricks and chain slings, or shown upon a tablet or ring attached; wire rope slings must also be marked or described in a notice to be exhibited. Chains must not be knotted and packing must be used when lifting loads with hard edges. Dangerous equipment must be fenced off wherever practicable. Cranes and winches must be fitted with devices to prevent the accidental descent of loads; crane drivers' platforms must be fenced and the design of crane ladders is regulated. The discharge of steam must be controlled as far as practicable—particularly where it is liable to obscure the operator's view; and the feet of derricks must be guarded or secured to prevent accidental lifting out.

Part IV includes further regulations dealing with lifting machinery and cargo working. Escape arrangements must be provided inboard for workers handling bulk cargoes; cranes may be loaded beyond the safe working load in exceptional cases subject to the engineer's approval, the owner's written permission and the permanent recording of the overloading; unattended, suspended loads are prohibited; all employees working lifting machinery must be over 16, and competent and reliable; clear quay space must be maintained at the foot of ship's gangways, and for a width of 3-ft. from the quay edge; deck and cargo stages must be secure; trucks must not be used on steep stages between ship and shore; slippery stages must be sanded; open hatches not in use must be guarded or covered if the coamings are less than 2-ft. 6-in. in height; hatch coverings must not be used for any other than their proper purpose and must be correctly replaced; the direct attachment of hooks to packages is restricted; working on skeleton decks is regulated; rules for stowing dangerous cargo are provided; any beams left in position at a working hatch must be secured; signallers must be employed—one for every fall; workers proceeding to or from a ship must be conveyed in sound boats in charge of competent persons.

Part V simply states that the safeguards provided in the Regulations must be properly used and not removed or interfered

Port Operation—*continued*

with; and Part VI forbids the use of appliances which do not comply with the regulations, places the ultimate duty of compliance upon the employers of the work people concerned, and refers finally to the duty of keeping and producing a Register of the appliances. (The important subject of the Register is dealt with hereafter).

The Factories Act, 1937

Section 105, in Part VII of this Act, deals particularly with docks. Section 106 relates specifically to ships, and the two sections, taken together, are headed "Docks, Wharves, Quays, Warehouses and Ships."

Section 105 provides that certain parts of the Act shall apply to the following as though they were factories:—

Every dock, wharf or quay.
Any warehouse belonging to dock, wharf, or quay owners.
Any railway line or siding used in connection with the above.
Any warehouse in or for the purpose of which, mechanical power is used.

The parts of the Act which ar thus made applicable to port operation deal with the following matters:—

Steam boilers (Section 29).
Home Office powers to prescribe safety regulations; and the power of a court of summary jurisdiction to make orders as to dangerous conditions and practices (Section 38).
Welfare regulations (Section 46).
Regulations for safety and health (Section 47 to 60, so far as they apply).
Notification and investigation of accidents and industrial diseases (Sections 64 to 69).
Provisions with respect to premises where part of a building is a separate factory (Section 102).
Exhibition of Notices and Regulations; keeping and production of Registers (Sections 114, 115, 116, 117, 119, 120 and 121).
The powers and duties of Inspectors; and as to Home Office Regulations and orders (Sections 122, 123 and 129).
Interpretation of the expression "factory"; and regulations regarding young persons employed (Sections 151 and 153).

The student is referred to the Act itself for the purpose of the detailed study of the Sections mentioned above, but a note is inserted below relating to the keeping of the special Registers concerning (1) chains, ropes and lifting tackle and (2) cranes and other lifting machines.

Section 36 (1) (e) requires that "no chain, rope or lifting tackle, " except a fibre rope or fibre rope sling, shall be taken into use in " any factory for the first time in that factory unless it has been " tested and thoroughly examined by a competent person and a " certificate of such a test and examination specifying the safe " working load and signed by the person making the test and " examination has been obtained and is kept available for inspec- " tion." Sub-section (g) further requires that "a register con- " taining the prescribed particulars shall be kept with respect to " all such chains, ropes or lifting tackle, except fibre rope slings." An Order, entitled The Chains, Ropes and Lifting Tackle (Register) Order, 1938, was subsequently made, prescribing the particulars that must be entered in the Register. These include the name of the occupier and the address of the factory; details of each piece of gear; date of first use; date of each examination and name of examiner; particulars of any defects found and remedial steps taken; dates and numbers of certificates of examination and particulars of the person who issued the certificate; dates of annealing or other heat treatment.

Section 24 (6) requires that "no lifting machine shall be taken " into use in any factory for the first time in that factory unless " it has been tested and all such parts and working gear of the " machine as are specified in Sub-section (1) of this section have " been thoroughly examined by a competent person and a certifi- " cate of such test and examination specifying the safe working " load or loads of the machine and signed by the person making " the test and examination has been obtained and is kept available " for inspection." Sub-sections (1) and (2) prescribe that "all " parts and working gear whether fixed or moveable, including " the anchoring and fixing appliances, of every lifting machine " shall be of good construction, sound material, adequate sertngth " and free from patent defect, and shall be properly maintained" and that "all such parts and gear as aforesaid shall be thoroughly " examined by a competent person at least once in every period of " fourteen months and a register shall be kept containing the pre- " scribed particulars of every such examination." An Order, entitled the Cranes and and other Lifting Machines (Register of Examinations) Order, 1938, was subsequently made, prescribing the particulars that must be entered in the Register. These include the name of the occupier and the address of the factory; particulars of each crane or lifting machine; date of each examination and particulars of the examiner; and particulars of any defects found and remedial steps taken.

Further Application of the Factories Act, 1937

Section 105 of this Act goes on to make it clear that the provisions of Part II of the Act apply on dock estates to the following matters: Prime movers; transmission machinery; construction and maintenance of fencing; construction and sale of new machinery; cleaning of machinery by women and young persons; training and supervision of young persons working at dangerous machines; hoists and lifts; chains, ropes and lifting tackle; cranes and other lifting machines; and the construction and maintenance of floors, passages and stairs.

Health, Safety and Welfare under the Factories' Act, 1937

The following is an inclusive list of all the matters listed in the Abstract of this Act, a copy of which must be kept posted at each principal entrance, and elsewhere as may be prescribed:

Health

Cleanliness of factories; temperature; ventilation; lighting; drainage of floors; sanitary accommodation; meals in dangerous trades; underground rooms; lifting excessive weights; lead processes; notification of industrial poisoning or disease.

Safety

Fencing; transmission machinery; new machines; cleaning machinery; training of young persons; protection of eyes; hoists or lifts; chains and ropes and lifting tackle; cranes and other lifting machines; construction of floors; precautions against falls; precautions against gassing; explosions of inflammable dust or gas; steam boilers and steam receivers; air receivers; fire; and notification of accidents and dangerous occurrences.

Welfare

Drinking water; washing facilities; accommodation for clothing; facilities for sitting; first-aid.

The student is referred to the Abstract, and again to the Factories' Act itself, for the detailed requirements under the above mentioned heads. Many of them are set out in the summary of the Docks Regulations, given earlier, but one or two of special importance to port operators are noted below.

Fencing

Every part of the transmission machinery and every dangerous part of other machinery, and all parts of electric generators, motors, rotary converters, and flywheels directly connected to them, must be securely fastened unless in such a position or of such construction as to be as safe to every person employed or working on the premises as if securely fenced. A male person over 18 may, however, approach unfenced machinery in motion in certain strictly limited contingencies and subject to conditions specified by the Secretary of State.

Moving parts of other prime movers, and flywheels directly connected to them, and the head and tail race of a water wheel or water turbine, must be securely fenced irrespective of their position.

Fixed vessels, pits, etc., containing scalding, corrosive or poisonous liquids must, unless the edge is 3-ft. above the adjoining ground or platform, be securely fenced to at least that height or be

Port Operation—continued

securely covered; where this is impracticable, other precautions, so far as practicable, must be taken.

All fencing must be of substantial construction and be maintained in an efficient state. It should be noted that under S.R. & O., No. 641 (Operations at Unfenced Machinery Regulations 1938) certain necessary operations may be carried out, under defined conditions, to machinery in motion. Stress is laid upon (1) the wearing of a close-fitting, single-piece overall; (2) the immediate replacing of guards after any examination or lubrication; (3) the securing of ladders; (4) the nearby attendance of a second person; (5) measures to prevent anyone else being in danger (vide "Prescribed Leaflet for Machinery Attendants," Form No. 280, issued by the Factory Department, Home Office).

Transmission Machinery

Devices or appliances for promptly cutting off the power from the transmission machinery, must be provided in every room or place where work is carried on. Efficient mechanical appliances must be provided to move driving belts to and from fast and loose pulleys. Driving belts must not rest or ride on revolving shafts when the belt is not in use.

Protection of Eyes

Goggles or effective screens must be provided in processes specified by the Secretary of State. For example, at ports where pitch is shipped, it is desirable to provide eye shields and ointment for the use of the dock workers.

Hoists or Lifts

Every hoist or lift must be of good mechanical construction, sound material and adequate strength and be properly maintained. It must be thoroughly examined every six months by a competent person whose report must be entered in or attached to the General Register.

Every hoistway must be efficiently protected by a substantial enclosure and landing gates, with efficient inter-locking or other devices. The safe working load must be marked conspicuously on each hoist. Additional safeguards (e.g., inter-locking gates for cages) must be provided on hoists used for carrying persons, whether with goods or otherwise. The requirements are somewhat less stringent in the case of hoists constructed before the passing of the Act, hoists not connected with mechanical power, and continuous hoists.

Every teagle opening or similar doorway used for hoisting or lowering goods must be fenced (except when the hoisting or lowering is going on at that opening) and be provided with a handhold on each side of the opening.

The Shipbuilding Regulations, 1931

The Building (Amendment) Regulations, 1931

In the matter of safety measures, the port operator must look further than the Docks Regulations and consider also the Shipbuilding Regulations, 1931, and the Building (Amendment) Regulations, 1931.

The Shipbuilding Regulations "apply to the construction and repair of ships in shipbuilding yards"; and it is of importance to Port Authorities to note that, for the purpose of these Regulations, a shipbuilding yard is defined as "Any premises in which any ships, boats or vessels used in navigation are made, finished or repaired." Public dry dock is defined as "any dry dock which is available for hire." The Shipbuilding Regulations require (1) safe access for workpeople to all parts of the ship; (2) adequate and secure gangways between ship and shore; (3) platforms to facilitate the use of gangways; (4) sound ladders well secured; (5) footways, of planks, to be at least 18-in. wide; (6) footways to be provided across deck beams; and (7) all openings in decks and tank tops to be fenced or covered; (8) stages to be securely constructed, soundly fastened, of sufficient width and guarded from swinging; (9) adequate ventilation against injurious fumes in enclosed or confined spaces; (10) control of smoking and naked lights; (11) certificates of test in relation to oil tanks; (12) cleansing of oil tanks by steam jets before test; (13) the use of safety lamps or electric lamps in appropriate circumstances; (14) complete precautions against injury from falling materials; (15) adequate lighting; (16) training and supervision of young workers; (17) provision of ambulances and first-aid rooms; (18) protection for the hands and eyes of certain workers; and (19) that the workpeople shall themselves conform to safe working rules.

The Building (Amendment) Regulations, 1931 (amending the Building Regulations, 1926), apply "to all premises on which machinery worked by steam or other mechanical power is temporarily used for the purpose of the construction or the extension of a building." The main concern of these Regulations is with hoisting and lowering operations and with the fitness of the appliances used in connection with these operations. Special directions are included having reference to scotch derricks, guy derricks and tower derrick cranes. Detailed study of the full text of the Regulations is recommended.

Electricity Regulations (Factory and Workshop Acts 1901 to 1929)

These Regulations relate to the generation, transformation, distribution and use of electrical energy in premises under the Factory and Workshop Acts, 1901 to 1929, and they are almost exclusively concerned with safety measures. In view of the extensive use of electricity in modern dock operation, all port operating students should make a study of these Regulations.

Safety Organisation in Docks Industry

The National Joint Council for the Port Industry have for many years encouraged joint consultation in the ports on the matter of safety organisation. Regular joint meetings, comprising representatives of the management and the work-people, are held at which any accidents since the last meeting are reviewed and, if appropriate, recommendations for remedial measures are made. Poster display and other educative activities are widespread. One noteworthy result of the work these Committees is the improved readiness of workmen to get even minor injuries promptly treated at first-aid posts—a most valuable practice.

At some ports, there are separate joint Committees for the Traffic Operating Department and the Maintenance Department—the former being largely concerned with accidents connected with cargo handling and the latter with accidents arising out of the tradesmen's work as fitters, joiners, boilersmiths, painters and the like.

Accidents to Young Workers

Young persons are particularly prone to industrial accidents and the subject has received special consideration. Reference should be made to a booklet, published by the National Safety First Association, entitled "Starting Young Workers Safely in Industry," and also to a Memorandum entitled, "Accidents to Young Workers" (Form 1980, dated February, 1938) issued by the Factory Department, Home Office, after consultation with the National Confederation of Employers' Organisations. Stress is laid upon (1) taking new entrants around the works and pointing out the dangers (2) placing each new entrant under supervision of a competent adult worker; (3) removing accident-prone juveniles from dangerous jobs (4) the enforcement of factory discipline; (5) the instruction of managers and foremen in the overlooking of young persons; (6) the distribution of safety literature and the giving of talks, lessons, lantern lectures and the like.

The Petroleum Acts 1871 and 1879
The Petroleum (Consolidation) Act, 1928

Under powers derived from the above-mentioned Acts, and from their private Acts, dock and harbour authorities issue Bye-Laws—which require confirmation by the Minister of Transport—with respect to the discharge and handling of petroleum and carbide of calcium in their ports.

In many cases, Bye-Laws made prior to the passing of the Act of 1928 were re-drafted in the light of a Model Code of Harbour Bye-Laws issued in connection with that Act. The Model Code is undergoing further consideration with a view to possible improvements at the present time.

Two general safety measures applicable to petroleum and petroleum ships in harbours will be known to most people. The first is the common practice of placing shore tanks and petroleum discharging berths in a segregated area of the port, as far away

Port Operation—continued

as possible from all other type of trade. The second is the provision of a boom, operated by electricity or other power, which, when closed, cuts off the water surface of the petrol-discharging area from the rest of the water surface of the port.

The principal requirements of the Model Code of 1938 are as follows:—

(1) Every petroleum ship when nearing the harbour and when in the harbour must display a red flag (with white circular centre) by day, and a red light by night, not less than 20-ft. above the deck (with modifications for small craft).
(2) The owner of a petroleum ship, immediately upon arrival, must give the Harbour Master particulars of the cargo and its stowage.
(3) Every petroleum ship must be berthed, and remain berthed, in accordance with the Harbour Master's directions.
(4) Cargo may only be landed or loaded after the giving of notice to the Harbour Master, and only at such places as he may approve; and only after the holds have been thoroughly ventilated.
(5) When discharge is complete, the holds and tanks must be rendered free from inflammable vapour, unless the tanks are closed down immediately and the ship leaves without delay except for the taking of bunkers, stores or ballast.
(6) Loading or discharging may not commence between sunset and sunrise unless the Harbour Master is satisfied with the lighting arrangements on ship and shore; but if work starts before sunset it may continue afterwards unless there is a breakdown when work must cease until sunrise.
(7) Fires and artificial lights are forbidden at or near loading or landing places; but lamps and cookers of approved safety types may be used, as also may the ship's own power if of approved classification.
(8) Smoking is prohibited at or near the landing or loading place; and nobody may carry matches or any appliance whatsoever for producing ignition.
(9) Vessels must be staunch and free from leakage, so must pipes and other appliances; work must be continuous so far as possible; cargo must be removed from quays immediately away from the harbour or to a licensed place of storage or into a ship.
(10) No petroleum spirit must be discharged or allowed to escape into the waters of the harbour.
(11) The Owners of ship and/or cargo must adopt fire precautions at the landing or loading place.
(12) Hammers or other instruments liable to cause sparks must not be used upon the hatches or tank lids.
(13) Fires and lights on the quays must be of approved safety types.
(14) Petroleum ships must keep 100-ft. between them if the Harbour Master requires, unless transhipment is proceeding.
(15) During discharging or loading, there must be on board a watchman and a responsible person to give effect to the Bye-Laws.
(16) The Harbour Master must be afforded every reasonable facility for inspection.

The Model Bye-Laws relating to Carbide of Calcium are similar to those for Petroleum, given above, in respect of notice to the Harbour Master, ventilation of holds, prompt removal from quays, watchman and responsible person on board and facilities for inspection. In addition they require (1) that carbide of calcium may only be brought into the harbour in strong metal vessels hermetically closed; (2) the containers may only be opened in some licensed place of storage; and (3) precautions must be taken to prevent the contact of water or moisture with the Carbide of Calcium and, where such contact may have occurred, to prevent the gas evolved being ignited.

At some U.K. ports, Bye-Laws made prior to 1938 remain in force and the commencement of discharge during the hours of darkness is never allowed. Petroleum berths at such places are often in close proximity to other working berths and the greatest degree of safety procedure is deemed necessary.

The Infestation Order, 1941—S.R. & O., 1993

This Order was made by the Minister of Food under the Defence (General) Regulations, 1939, and it affects port authorities in so far as they own warehouses for the storage of food or forage. The Minister may (1) give directions with respect to the reception and handling of such goods and the use of the warehouses; (2) prohibit the user of infested buildings; (3) prohibit the handling of infested goods; (4) order the disinfestation of the premises; (5) carry out disinfestation at the expense of the owner of the premises. Owners of such warehouses must give immediate notice to the Ministry of Food if the premises become infested. Infested means "infested by insects, mites, fungus, rats, mice or other vermin, or other animals, plants or living organisms likely to cause damage to, or deterioration, waste or loss of food or forage."

A common method of disinfestation is by (1) emptying the premises of all goods; (2) carrying out a thorough manual cleaning of the walls, floors and pillars, and (3) fumigating the premises with Hydrogen Cyanide. The use of vacuum cleaners and spraying with lethane and pyrethrum are other methods of disinfestation.

Food Inspection at Ports

The Public Health (Imported Foods) Regulations, 1937
The Public Health (Imported Milk) Regulations, 1926
The Public Health (Preservatives, etc., in Food) Regulations, 1925 to 1940

Under these Regulations, foodstuffs coming from foreign and home ports are subject to inspection by the Port Health Authority, and samples are regularly taken by the Examining Officer of Customs. The Port Health Authority's officers also pay visits to ships, wharves and warehouses for the purpose of inspecting consignments of foodstuffs. Samples are taken for analysis as may be considered necessary and unfit food may be ordered to be destroyed.

Dock Railways—Safety Precautions

It is common practice for dock authorities, in laying out and operating their internal railways, to observe generally, and where applicable, Ministry of Transport recommendations as laid down in "Requirements for Passenger Lines and Recommendations for Goods Lines," 1928. The conditions on dock railways, however, are so completely different from main line working—notably in the matter of speed—that the main consideration is that of clearances. The standard clearance aimed at between any dock railway line and goods stored in the open is 5-ft. The clearance between fixed structures and the maximum width of rolling stock over body work is laid down as 2-ft. 4-in. (minimum) and 2-ft. 10-in. (desirable). Signalling arrangements, warning notices and speed limits are arranged by every dock authority according to the varying circumstances and at places of particular difficulty or congestion. The safest rule in shunting work is for the shunter to proceed ahead of the train whenever an approach is being made to road crossings, bends or bridges, and to control operations from the crossing himself.

(To be continued)

Tests to Prevent Silting at Rosyth.

A large scale working model of the Firth of Forth has been constructed at the National Physical Laboratory, Teddington, to help in devising means of preventing silting in the neighbourhood of the Royal Naval Dockyard at Rosyth.

The model, which has been built for Admiralty by the Hydraulic Research Organisation, is 85-ft. long and reproduces all the main contours of the Firth from Stirling to a point below the Forth Bridge. Sand and silt are introduced and water is allowed to run in at one end, and at the other end is a large rectangular plunger, operated by an electrical and hydraulic device. The plunger causes the flowing water to rise and fall and so reproduces the effect of tides. Already considerable advances have been made in studying the probable effects of water diversion and new construction on banks, shoals and other features of the waterways.

Speed at Sea and Despatch in Port

Need for Improvement in Port Organisation and Equipment

By W. MacGILLIVRAY.

At the Spring Meeting of the Institution of Naval Architects, held in London on 17th March, 1948, a Paper with the above title was read by Mr. W. MacGillivray, Managing Director, Prince Line, Ltd., and as the subject is of much interest to port and shipping circles, we are, through the courtesy of the Institution, reproducing those sections which directly concern those connected with port operation.

The author explains that in the construction of post-war merchant ships, both liner and tramp, there is a growing tendency towards greater speed at sea. This can only be achieved by considerable extra capital outlay, heavier consumption of fuel, and increased running costs. The speed of port operations, on the other hand, has for various reasons declined and the time gained at sea is being lost by congestion and delays in port.

Considerable economies could be effected by improvements in port organisation and equipment, resulting in more expeditious handling of cargo before delivery and after discharge; the use of labour in two shifts of eight hours, rather than one shift with overtime, is advocated; and attention is drawn to the sub-division of cargo holds and means of equalising the time occupied by cargo operations at all hatches.

The conclusion reached is that the full benefit of higher speed at sea can only be attained provided the time of turn round in port is reduced and that much more attention should be devoted to the many problems of handling of cargo, both in the ship and ashore.

Time at Sea and Time in Port

It was usual in pre-war days to count upon a ship as being roughly 200 days at sea and 165 days in port. The figures, of course, varied in different trades and even from year to year, but on the whole a shipowner could calculate his time with some degree of accuracy.

The following statistics are taken from the records of a cargo liner company, which might be regarded as typical of this class of shipowning. It has several trades to various parts of the world and its ships vary in size from 3,000 to 11,000 tons deadweight and the speed from 12 to 15 knots. The types of propulsion are diesel, steam turbines, and steam reciprocating coal or oil burning.

During the war, over a period of 6 years, the average earnings of this company's fleet were almost exactly what the Ministry of Transport intended them to be, i.e., a basic rate of hire per gross registered ton to cover operating costs plus 10 per cent. per annum on the first cost of the ships for depreciation and interest. This fact is mentioned to indicate that the fleet can be regarded as a fair sample of the cargo liner industry.

In the years 1937 and 1938 the average number of days per vessel spent at sea and in port were 204 and 161 respectively. During the years 1946 and 1947 the corresponding figures were 163 days at sea and 202 in port, a reversal of the pre-war time.

The averages, of course, vary somewhat in individual trades, being influenced by several factors. In one trade, where a fairly accurate comparison can be made, as the small type of ships employed are always nearly full of cargo, the times were:—

	At Sea.	In Port.
1938/1939 ...	197	168
1946/1947 ...	146	219

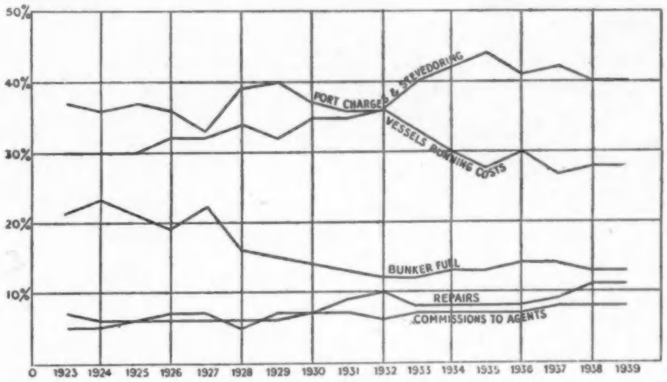
These ships are, therefore, spending 51 days a year more in port than they did prior to the war, which, in this particular trade, represents one round voyage lost.

Whilst the respective "days at sea" and "days in port" must vary widely in different trades, depending upon distances between ports, types of cargo, etc., it is obvious that conditions ashore to-day, particularly in some countries, can only be described as deplorable. The time which shipowners are saving at sea through building faster ships at very great cost is being entirely nullified by detention in port for which post-war conditions are mainly responsible. It is difficult to measure in terms of money these delays and their effect on transport costs, but it is apparent that they are very considerable, as nowadays many liner companies give continuous employment to their seagoing personnel. There is thus little saving, if any, in operating costs, and delays in home ports are equally as expensive as delays abroad.

Analysis of Shipowners' Operating Expenses

The following graph is compiled from the records of the company mentioned in the previous paragraphs and indicates how the operating expenses were apportioned during the seventeen years 1923 to 1939 inclusive.

The only item not included is depreciation on vessels of the fleet:—



Vessels Operating Costs

Port charges and handling expenses form a very large portion of the total outlay, the average over the long period of years being 38.5 per cent.

Vessels' running costs, which include time in port as well as time at sea, cover wages and victualling of the crew, officers' pension fund, overtime and leave, deck and engine stores, insurance, and sundries comprising various items too numerous to mention. The average for seventeen years was 31 per cent.

It will be observed that the largest items, port charges and handling expenses, and vessels' running costs, were fairly consistent during the period.

Bunker fuel formed a comparatively modest proportion of the outlay, ranging from about 21 per cent. during the years 1923/1927, 14.5 per cent. during 1928/1931 to 13 per cent. in the years 1932/1939 years. The reason for the fall was largely the increased use of motor ships.

The relative cost of repairs was fairly consistent, showing a slight tendency to rise from 1932 onwards.

As a result of the war, there have been rather startling changes in costs, as the following figures indicate:—

	1938/1939 %	1946/1947 %
Port charges and handling expenses	38.5	51
Vessels' running costs	31.5	27
Bunker fuel	15	7
Repairs	8	6
Commissions to agents	7	9
	100	100

Measured in terms of money, every item of expense has, of course, risen very considerably since 1939, but in relation to the total, the percentages of three have fallen, i.e., vessels' running costs, bunker fuel, and repairs. The principal reason for the low proportionate costs of bunker fuel and repairs is that all the ships are modern, averaging only six years, a large proportion of them being diesels.

Port charges and handling expenses now form 51 per cent. of the operating costs, a very formidable and significant figure. It probably varies widely in different companies depending upon the

Speed at Sea and Despatch in Port—continued

nature of their trade, the type and age of their ships, and other considerations, but none the less cannot fail to be giving every shipowner a good deal of concern.

The pre-war statistics quoted, unfortunately do not sub-divide port charges and handling expenses, but this has been done in the 1946/1947 figures and indicates that 11 per cent. represents port charges and 40 per cent. handling expenses, which latter

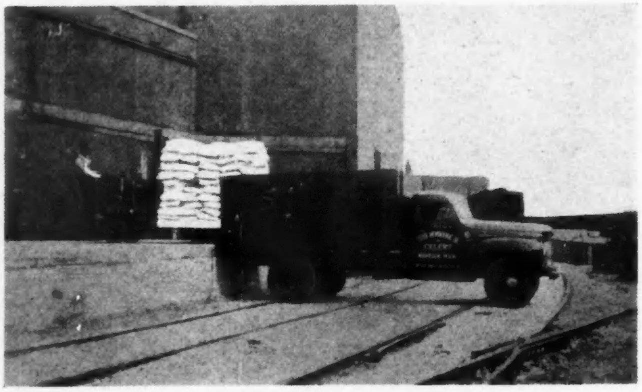


Fig. 1.—Unloading pallet from lorry with fork-lift truck.

include stevedoring, winchmen, tallying, overtime, waiting time, taking off and replacing hatches, dunnage, and the numerous sundry items which invariably find their way into a stevedore's account.

Attention has already been directed to the excessive time spent in port in these post-war days. Of the vessels' running costs, which form 27 per cent. of the shipowners' expenses in the example quoted, 201/365ths were incurred in port, i.e., 15 per cent. of the total, which, together with 51 per cent. for port charges and handling expenses, come to 66 per cent. The figure is actually a little in excess of this, as the cost of fuel for cargo handling purposes has not been included.

Despatch in Port

It is evident that the shipowners' greatest individual worry to-day is despatch in port. His primary target is to get back to the 1939 level, and if that can be achieved it will be a very material accomplishment. Labour is the key to the situation and until the growing tendency to do less and less for more and more ceases, there will not be any improvement. Starting work late, finishing early, restrictive practices—all these combine to reduce output.

These troubles will not disappear overnight and it will take time for the upheaval caused by the war to subside. Good wages and an improved standard of living are essential and desirable things, but, in the long run, they must be combined with a good day's work.

A return to the 1939 level, however, should only be a stage in the ultimate aim to reduce the time spent in port. This aspect of shipowning has not, in the past, received the attention it deserves. Much greater regard has been paid to reducing the time at sea, although what is being achieved is only possible at considerable additional capital outlay and increased operating expenses.

The speed at which a ship can discharge or load her cargo depends chiefly upon the efficiency of:—

(a) Port equipment and organisation.
(b) Ship's winches and derricks.
(c) Division of cargo holds.
(d) Other aids to assist despatch.

Port Equipment and Organisation

It is obviously to the benefit of both shipowner and port authority that there should be co-operation in the handling of cargo. This applies not only to the actual loading and discharging operations. No matter how efficient may be dock cranes, ship's derricks and winches, delays to the vessel will occur if there is congestion ashore due to slowness in removing the cargo from quays and sheds. The problem does not end here. Narrow and awkward approaches to and exits from docks and riverside wharves often produce a "bottle-neck," which results in delay throughout the various handling stages.

At some ports, the sheds extend so near to the edge of the quay-side that the cargo must be "fed" on board from the doors of the shed, thus causing congestion. The floor space of the sheds is often obstructed by pillar supports, which prevent the ready stowage of incoming or quick transit of outgoing cargo.

The holds of ships are confined spaces where only a certain number of men can work at any one time, whereas practically unlimited labour, if it is obtainable, can be employed clearing quays and warehouses. It is, therefore, essential that as much efficient labour as possible be concentrated in the holds of ships, and the work of discharge completed as quickly as possible. An incentive should as far as possible be provided to the stevedores by the payment of piecework rates, particularly in these days where quick turn-round of ships is so necessary, not only on account of high operating costs but, more important still, economy in the use of shipping space at a time when tonnage is in short supply.

It is only possible within the scope of this paper to make brief suggestions towards the improvement of dock equipment. In giving consideration to its character and extent, regard must be paid to the conditions of the various trades served by particular ports, the volume of existing and potential traffic, and the type of tonnage concerned.

The ideal berth for the average 10,000-ton deadweight vessel should have four 3-ton electric 70-ft. jib cranes and two 6-ton cranes, all movable under their own power, with 6-ton cranes spaced one forward and one aft, also a 15-ton crane between every two berths, all able to discharge into or load from either transit shed, lorry or railway wagon.

Given such equipment, supplemented by the ship's derricks for working overside, an adequate supply of satisfactory labour, and provided the cargo can be brought alongside or removed to keep pace with the loading and discharging operations, there should be a great improvement in the present rate of despatch.

Fig. 2.—Unit loads of bagged coffee on 66-in. by 46-in. pallets in transit shed. They lend themselves well to stable piling of the most common size of bags and permit relatively high stacking without undue drift away from horizontal.

An alternative layout for a port where lighters are largely used could be a pontoon equipped with mobile cranes and separated from the quay to enable lighters to be operated between ship and quay. With a combination of cranes and ships' gear the cargo could thus be worked with double gangs from any hold either entirely to lighters, or to quay, or to both together.

Too little time is worked in port during the twenty-four hours. Under present conditions, where there is such a shortage of labour

Speed at Sea and Despatch in Port—continued

at many ports, it seems useless to think of more than one shift of eight hours. Nevertheless, in the hope that the supply of labour will ultimately become more abundant, two shifts of eight hours each are suggested as an object to be kept in view. It is a much better system than one shift of eight hours, plus overtime, which latter is not only costly but in some respects uneconomic. Stevedores who have worked a full shift cannot reasonably be expected to maintain output throughout overtime hours, and the law of diminishing returns becomes apparent. The two-shift system should apply not only to stevedores but to port labour as a whole, including lighterage and railway interests, to relieve the congestion which would otherwise result. This would also help to overcome the shortage of railway wagons, which is so much in evidence to-day.

Ships' Winches and Derricks

As cargo-handling appliances are not available at all ports, especially those abroad, ships must be equipped with their own so as to be independent of shore cranes in case of necessity. Ships' gear and dock cranes are therefore bound to overlap at times, but the former can be usefully employed in discharging into or loading from lighters simultaneously with quay operations by shore cranes, or supplementing the latter. It is a question for those concerned to decide how best to use the respective facilities.

Even without the assistance of port cranes, adequate ships' winches and derricks, if properly designed, can handle cargo under present conditions as fast as it can be brought alongside or taken from the vessel. Where acceleration is necessary in many cases is on shore. Some years before the war, owing to a marine casualty, it was necessary to operate a fortnightly service from New York to South America for several voyages with three large motor ships instead of the usual four. This entailed a considerably quicker turn round, especially at New York, where it was necessary for them to proceed first to a pier to disembark passengers, thence to another pier several miles away to discharge cargo, and eventually to return to the first pier to load outward cargo

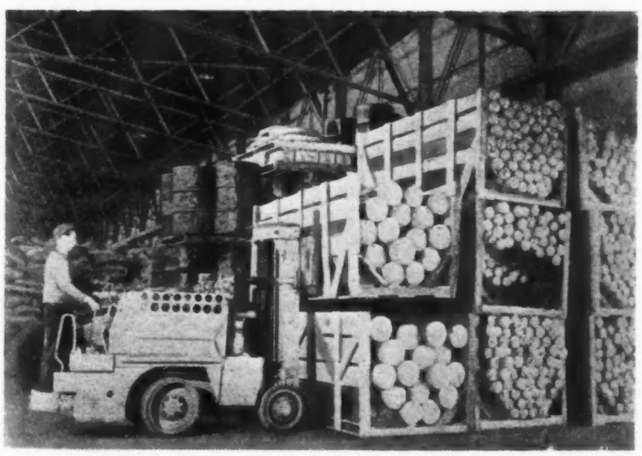


Fig. 3.—Rolls of paper and linoleum in variable lengths which cannot be safely handled on pallets. Special racks shown serve also for other commodities of similar size and shape.

and embark passengers. The average quantities of cargo handled were:—

Inwards ...	6,000	tons weight consisting of miscellaneous cargo from four ports of loading.
Outwards	8,000	tons wt./meas. consisting of general and refrigerated cargo stowed for four ports of discharge.
	14,000 tons.	

The ships arrived at New York on Wednesdays and sailed outwards on Saturdays, the entire operation occupying three days. Work, of course, proceeded continuously throughout that period, three shifts per day being worked, but even so, it does indicate what can be done with efficient ships' gear and ample skilled labour.

All ships are, however, not so adequately equipped, and it is in this direction that improvements in despatch can be achieved

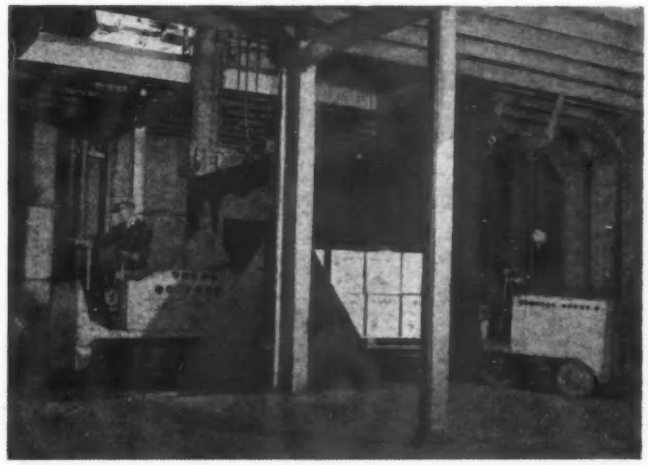


Fig. 4.—Tractor and empty in hold are ready to board the lift as soon as the tractor and load get off. Synchronisation is normally almost perfect; lift rarely ascends without empty or descends without load.

in cases where the vessel, whether she be cargo, liner or tramp, is dependent upon her own gear.

Derricks should be long enough to reach outboard to plumb barges that may have to berth alongside at an angle, if the whole of the cargo is being discharged overside, so as to keep all holds working together, or to plumb at least two lines of rails when working ashore. One heavy derrick at the main hold for cargo liners is almost essential nowadays, with a capacity of 30 to 50 tons. Two 10-ton derricks, one forward and one aft for medium lifts, are also desirable.

Large barrels on the winches are an important factor, with large smooth whipping drums. In some ports these whipping drums are used to advantage where quantities of light general cargo have to be dealt with, particularly where the lift is restricted by labour customs.

Although British shipowners do not generally favour cranes in place of the usual winches and derricks, it is noteworthy that the Swedish Johnson Line are building five 19½-knot 9,100-ton deadweight motor ships, equipped with 14 electric cranes at seven holds. They have an exceptional reach of 41-ft., making it possible to handle goods even on the second railway track from the quayside. The lifting capacity of the cranes varies from 2 to 5 tons, and up to 10 tons in some hatches by operating cranes in pairs. Two of them can be used for lifting machinery parts out of the engine-room through the skylight, and by means of special devices they can also handle the lifeboats. The operating controls, consisting of two levers, are said to be extremely simple, and the cranes are provided with effective safety devices. In order to afford the cranes more unobstructed space the mainmast has been eliminated whilst the foremast has no other function than for the navigation light, aerials, signal halyards, etc.

Division of Cargo Holds

The "main hold" idea, one of the surviving traditions of the sailing ship age, perpetuating as it does an entire absence of balance as between the different cargo compartments of the ship, is still responsible for a certain amount of delay. Some 2,800 Liberty ships and quite a number of British ships were built during the war with Number 2 hold approximately twice the size of each of the others.

Speed at Sea and Despatch in Port—continued

If the cargo were homogeneous and could be loaded and discharged at a uniform rate at all hatches, the ideal arrangement for despatch would be, of course, to have holds of identical size.

In open roadsteads, however, cargo is more difficult to handle when it has to be stored in the fore and aft holds; and some types of goods require a large hold, e.g., rails, steel pipes, etc. These conditions can be, to a great extent, overcome by double rigging the large holds, and this has been recognised good practice in large cargo liners for many years.

Other Aids to Assist Despatch

(a) Hatch Beams and Covers.—The practice of covering hatchways in many ships differs but little from that in use on the earliest

Fig. 5.—Platforms are built above bilge in the hold to facilitate unit-load stowing.

steamers and consists of heavy steel beams, which support the wooden covers. As the size of hatches increased, the number of beams also increased, until by now they number from eighty-five to one hundred in a three-decked cargo vessel of average size.

At least 10 per cent. of stevedores' time is occupied in the wholly unproductive work of uncovering and covering hatches at the commencement and completion of each day's work, further loss being involved in covering up on account of rain, shifting work from one deck to another, etc. The use of roller hatch beams reduces such losses to a minimum, whilst preserving the elasticity and convenience which the use of portable covers—wood or steel—confers. An appreciable saving of time each day in port, with consequent saving of wages (often at overtime rates), is thus possible, which, in the course of a year, amounts to a very substantial sum. Injuries to workmen and damage to cargo and tank-tops by accidentally dropped or displaced beams are precluded. The width of the hatchway is automatically increased by seven or eight inches, because the destructive beam sockets are dispensed with and damage to bag and other cargo is, for the same reason, avoided. Clear decks are ensured, as they are not encumbered with unshipped beams; should exceptionally large pieces of cargo have to be loaded, the beams can be unshipped with greater ease than socket beams.

Various types of hatch covers—wood and steel—are invented from time to time and opinions vary as to their utility. This is a subject which ought to be given greater attention, as the old type of wooden hatch which is still widely used to-day is frequently damaged and costs an appreciable sum to maintain.

(b) Palletization.—This method of stowage is being employed with much success by Canada Steamship Lines, Ltd., in their Great Lakes' ships. It has great possibilities with bagged, baled, and cased goods.

Palletization is the stowage of goods on pallets or trays and the system is used with the aid of fork-lift trucks and trailer-tractors for stacking and transporting.

Goods can be palletized either at point of origin or on arrival at the wharf, the work in the latter case being done by the stevedore. If any packages are too small or fragile to go on an ordinary pallet they are stowed in a pallet-box, which can be dismantled when returned empty. Time and expense would be saved if all goods were palletized at the factory, and shippers are being encouraged to do this wherever possible.

On arrival of lorry or railway wagon at the wharf the loaded pallets, weighing from one to three tons, are lifted from the vehicle by a fork-lift truck and stacked in the transit shed. Incidentally, great economy of space can be gained by this method, as the fork-lift truck can stack up to about 20-ft. in height.

Many experiments have been carried out to determine the quickest method of conveying the loaded pallets from shed to the ship's hold, and the following method has been found to be the best. A fork-lift truck unstacks the loaded pallet in the shed, places it on a trailer drawn by a tractor to the ship's side, then up a gangway through a side port to the 'tween deck and into an elevator which conveys trailer and tractor down to the hold.

The loaded pallet is lifted from the tractor in the hold by a fork-lift truck and stowed.

When the elevator descends to the hold it finds an empty trailer and tractor waiting to ascend on the way back to the shed for another load. As the elevator reaches the 'tween deck and the tractor and trailer run off, another on the way from the shed with a load is waiting to descend.

The time for a complete round trip of the elevator, 'tween deck to hold and return, is about 30 sec.

The number of tractor-trailer units employed depends upon the distance from transit shed to ship. No uncoupling of the tractors and trailers is necessary, as the elevator is large enough to accommodate both.

Loading of pallets in the 'tween deck takes place simultaneously, the tractor-trailers entering through one of the other side ports.

When loading in the hold has been completed, the elevators are brought to the 'tween deck and a tier of pallets put upon them by fork-lift trucks. They are then lowered, another tier of pallets put on, and so on until the way of the elevator hatch is filled. The elevator hatch covers are then put in place, which leaves the way of the elevator hatch in the 'tween deck available for stowage.

At discharging port the process is reversed.

Packages which are liable to fall off the pallet when they are being lifted or transported have wooden collars tied with rope to keep them in place.

Fig. 6.—Start of typical unit-load stow at forward end of 'tween deck. As a general rule, one two-high row of loads extending the entire width of the ship is placed and made tight before starting the next. No dunnage is used. Any spaces are filled with loose packages of freight.

Although pallets cannot be used for every type of cargo, almost anything can be picked up by a fork-lift truck without manual handling. Some goods which cannot be palletized, such as rolled

Speed at Sea and Despatch in Port—continued

paper in variable lengths, are loaded in special racks. Packages which are too light or bulky to handle on pallets are usually loaded in the forward end of No. 1 hold which, owing to its shape, is not suitable for unit load stowing.

The use of pallets in the ship means, of course, a loss of space, although to some extent they take the place of dunnage. The loss is, however, said to be no more than 10 per cent. and is a factor of small importance compared with the gains resulting from unit load stowage. It is claimed that palletized goods can be stowed so as to prevent shifting of the cargo in heavy weather by filling in any spaces with smaller units of freight.

The saving of labour by the system is considerable. In the loading of a typical commodity, say cartons of canned food, 70 of which are placed on a pallet, two mechanical hauls (from shipper's lorry to transit shed and thence to ship's hold) and three mechanical handlings now do the work that formerly required 17½ hauls and 210 handlings when it was done manually.

Two thousand tons of package cargo can be loaded in from 8 to 12 hours at a cost which compares favourably with pre-war, although wages of longshoremen have doubled since then.

Whilst the system seems well suited to Great Lakes' traffic, where the type of cargo permits and where it has been possible to reduce the number of men in a stevedoring gang as a result of the use of fork-lift trucks and tractor-trailers, it is doubtful whether full palletization is possible in deep-sea trades. A certain amount of palletizing is being done in the United States, but difficulty is being experienced with labour, who are disinclined to reduce their numbers. The cost of pallets for a full cargo is considerable unless they can be used again. The expense of returning a pallet from, say, Birmingham to a factory in the Middle West, might be more than it is worth. In the Great Lakes' trade, pallets can be pooled and used again on the return voyages, but not many deep-sea trades could be organised on such lines. In such trades the greatest benefit of the system would probably be obtained by confining their employment to quay and shed operations, particularly where economy of space is necessary. The pallets could be lifted into the holds by the ship's gear and their contents stowed in the normal manner, the empty pallets being returned to the quay. The cargo could be similarly handled at discharging port.

Palletization of goods is certainly a system which might well be investigated in this country, as there is undoubtedly scope for improvement in the present methods of handling cargo.

(c) "The Ship and Shore" Cargo Loading System.—This system has been invented by Mr. Charles E. Ellis, of New York, who claims that very great economies in time and money can be made by operating ships specially designed for the carriage of package cargo which, he contends, will amount to 80 per cent. of the non-bulk tonnage moving through New York in the years to come. It is designed to carry unit loads of various types—pallets, containers, etc., up to 20 tons in weight and dimensions of 18-ft. x 8-ft. x 7-ft. The basic unit of the system is a low-slung, wheeled carriage operating on rails.

The carriages, which run on swivel wheels, are moved by a chain conveyor from the shore rails, up a hinged ramp to the ship, through side ports and into an elevator, which lowers them to the required level.

The rails, which do not interfere with the ordinary use of ship or pier, are installed within the ship and flush with the pier floor. The rate of loading is claimed to reach 1,500 tons to 2,000 tons per hour at costs ranging from five cents to fifty cents per ton, which latter cost includes palletization at the pier. No dunnage is required in the ship. Once on board, the cargo is locked safely in place and it cannot be damaged by overloading or shifting, as each carriage is fastened individually, no carriage touching or resting upon another. Pilferage is reduced to a minimum because of the unit nature of the loads carried.

The cost of converting a 10,000 tons deadweight three-deck cargo liner is estimated to be £75,000 to £100,000. It is claimed that a vessel thus equipped can easily turn around in port in two days, making it possible on a given route for two ships to do the work of three fitted with the usual handling gear.

The cost of equipping a pier at New York, where tidal conditions vary, is said to be about £60,000.

It would seem that the system has its limitations and is only suitable for regular trades, such as United States intercoastal, where package and other freight which can be accommodated on pallets or in containers predominates, and where piers can be fitted with the necessary gear.

(d) Mechanisation.—The intelligent use of mechanical trucks, portable cranes, etc., can do much to speed up cargo handling operations, but one has to guard against the danger of over mechanisation. Unless the gear can be continuously employed, it may well result in costs being increased rather than decreased. Co-operation of labour is essential to ensure that gangs are reduced in proportion to the amount of manual work saved. Mechanical gear needs constant overhaul; repairing facilities have to be provided, engineers and their assistants employed in maintenance work, clerical staff required to check accounts and keep records —all these items which may be classified as "overheads" might easily offset the economies effected by quicker discharge or loading of the ship.

There is also a tendency for labour to become so accustomed to having mechanical assistance that they cease to perform work which is cheaper to do manually.

Not everyone, even in America, is convinced that benefits automatically follow by the use of mechanical gear. The following are extracts from a speech made by Captain Blanchard at the annual meeting of the American Association of Port Authorities in October, 1944, which adds emphasis to the last paragraph:—

> "Let us look back fifty years and see how we have improved. The piers were then uncovered and most of the cotton was hoisted into one hatch in a sailing ship by one horsepower—just a plain everyday horse. Then came the steamer and we had to cover the piers. Cargo had to be assembled ahead of time and instead of one gang and the horse we had steam winches and many gangs. Cargo had to be thrown out with speed and piled on the pier. Then, of course, we had the longshoreman—with a strong back and a feeble mind—and the hand truck. They worked ten hours a day and more. The production at that time was about one ton per man per hour. The hand truck was a happy tool for many years and the units which were being put in the ship ran about 1,500 lb., but we had to extend that. Labour was increased and the units were raised to two tons. That was partly due to the increased capacity of the ship's gear. Then we brought in the travelling crane; the first one was a Ford tractor with a lot of mechanism, a horrible looking thing, but it seemed to do the work. Since then we have brought in the lift-truck. At first labour was a little antagonistic and, when the foreman wasn't looking, they sometimes drove it overboard. Now they almost refuse to work unless we have the equipment. But in spite of this, the number of men in the gangs has had to be increased and the production per man per hour hasn't varied in the last forty years. It is still about one ton per man per hour. That is a rather strange thing, when you stop to think that we have put on the pier many thousands of dollars' worth of these patent toys. One gang years ago was about eleven men and the equipment cost about a hundred dollars—a few trucks and so on. For a gang of twenty-two men to-day the cost of the equipment is about five thousand dollars. With all these 'isms' and improvements, we haven't increased the production which we had in the olden days."

Conclusion

Notwithstanding the efforts which are being made at very great cost to increase the speed of ships at sea, it is evident that despatch in port is not correspondingly progressing. One cannot help feeling that the orthodox methods are in many cases somewhat out of date, and if the full benefit of greater sea speed is to be attained considerable improvements in the handling of cargo, combined with co-operation and economy in the use of labour, are urgently necessary.

British and American Port Administrative Systems Compared

By BRYSSON CUNNINGHAM, D.Sc., M.Inst.C.E.

There is to many people a pleasurable interest in comparing the different ways in which the same objects are achieved in various parts of the world and it is equally manifest in port affairs as in other matters.

A comparison of systems of port administration is specially intriguing for port officials, though to deal with all the various features of interest within the wide field of survey would require scope and space beyond the permissible limits of an article in this Journal. None the less it may be welcome and instructive to draw attention to a few outstanding aspects of the matter and it is proposed in the present article to discuss some divergencies of practice between this country and the United States of America.*

As might be expected, there are very pronounced divergencies of method and treatment in regard to port operation in the two countries, the reasons for which are certainly not quite obvious at first sight to the independent observer, nor are they altogether easy to understand by the student of port affairs.

To take one instance of a fundamental and striking character, it may be asked why are the Maintenance and Development of Rivers and Harbours in the United States placed under military jurisdiction and control, whereas in Great Britain such matters constitute a branch of civil engineering altogether distinct from army affairs, while as regards the improvement of estuary channels and harbour entrances, including means for their training, protection and safe navigation, these duties form part of the normal functions of a port authority. In the United States this is certainly not the case. They come within the province of the Corps of Engineers of the United States Army.

This allocation of responsibility seems to have arisen in part from primary considerations of State policy in regard to National Defence. In the Federal Constitution of the United States, the authority to control and regulate traffic over the water highways of the country has been vested in Congress and therewith the responsibility to take steps for their maintenance and improvement. Considering the national interests to be bound up in the efficient condition and use of the country's waterways, Congress has seen fit to entrust the obligation to an Army Board of Engineers which has exercised its powers for an indefinite period in the past and continues to do so in a most efficient manner at the present time.

Whether this attitude is strictly and theoretically justifiable is a matter for debate. There are several objections which might be urged against it. True, the United States Corps of Engineers is a competent body which has successfully treated problems of harbour and river navigation over a lengthy period, but the question arises whether they are in as good a position to deal with them as a civil authority, as is the practice in this country. Looked at from several points of view there are grounds for a negative answer.

In the first place the training and outlook of the military engineer is entirely different from that of his civil colleague. The former is necessarily versed in the theory of military tactics and envisages his duties from that particular point of view. The latter is devoted to the promotion of peaceful mercantile pursuits of which safe navigation is one and cargo-handling another, both without reference to military considerations, except, of course, in times of national emergency. A military training does not take account of the many facets of commercial enterprise, especially when coupled with shipping and navigation. Yet these are the essential features of port administration. The subject, in fact, is not germane to military affairs and policy; port supervision by a purely military organisation seems incongruous to English ideas.

In the next place the assignment of river and harbour improvement works to army control is arbitrary and in the absence of war-time conditions is without justification on prima facie grounds. Should occasion arise for military defence measures, these could and should be carried out by the appropriate agency, but the contingency is exceptional and not likely to arise in general.

Lastly, there is the question of local interest and participation. Harbours and ports are matters of independent concern. The State may conceivably be entitled to exercise overriding control, but the exercise of the powers of a port authority is undoubtedly best left in local hands. Each port and harbour has an identity of its own and predominating regard should be had to local wishes and expert knowledge. This can hardly be forthcoming from a national military organisation.

Another striking feature of American practice is the amalgamation of Rivers and Harbours under a single administrative body, though the functions of the two are essentially separate and distinct; at least they are considered so in British practice. In Great Britain, Rivers are administered by Conservancy and Catchment Boards except possibly in their estuarial portions which, if associated with port working, are placed in the hands of the appropriate port authority, who are naturally concerned with port entrance channels and the safety of shipping.

Such are a few of the outstanding differences in outlook and practice between Great Britain and the United States and they will repay careful attention and study. It may be of interest to take the cases of two typical ports of high standing by way of exemplification of the principles underlying the basic differentiation. We have two such cases to hand in the Port of London Authority and the Port of New York Authority.

The Port of London Authority, a body of 18 elected and 10 appointed members, constituted in 1909, owns and administers, with one insignificant exception, the whole of the various dock systems, at one time in independent hands, on both sides of the River Thames, but also with a single exception (a cargo jetty at Tilbury), it does not own the quays and wharves on the river frontage, although it has the power of veto over extensions or alterations to these river frontage quays and wharves, which are the private properties of wharfingers and trading concerns, on whose application licences can be granted by the authority for additional wharfage where required.

In regard to the river, the Authority may be said to own the bed, but not the banks. It dredges and deepens the channel, raises wrecks and removes obstructions, makes bye-laws for regulating traffic and maintaining purification of the stream, and it licences lightermen and watermen, but it does not provide river police, pilots, sanitary inspection, lighting or buoyage. The Authority owns certain warehouses in the City and derives revenue therefrom. It also undertakes at some of the docks the loading and unloading of ships, but at other docks this is done by independent stevedores and their employees.

A different type of autonomous authority is in existence at the Port of New York, which, although resembling the Port of London Authority in some respects, is fundamentally different in others. It was formed in 1921 by joint laws of the States of New York and New Jersey, approved by resolution of United States Congress after protracted enquiry by a Joint Commission. The Authority, as constituted, consists of six appointed Commissioners, three from each State and its jurisdiction extends over the whole area of the City and Harbour of New York. Its duties are to prepare and execute plans for the comprehensive development of the port; to acquire and construct terminal and transportation facilities within the port district for moving and handling goods by rail, highway and water and to operate them. The control of the piers on the river front of Manhattan Island is in the hands of the Commission of Docks of the City of New York, an independent body. Pilotage is supervised by Boards of Commissioners for the two States of New York and New Jersey.

The foregoing is a brief statement of the leading functions of the two most notable Port Authorities in Great Britain and America from which it may be gathered that there is a wide divergence in their respective formulations of the duties and functions of a port authority and the methods employed for their execution. There are, it must be added, a number of other variations both in principle and in detail in evidence at ports in the two countries; so that all that can be concluded from this brief survey is that treatment of the matter shows considerable conflict of thought and opinion among those qualified to judge the merits of the question.

*For a wider and more complete survey, reference may be made to the writer's "Port Administration and Operation" (London, Chapman & Hall, Ltd.).

Marine Beacons

Description of a Recent Australian Installation*

By CAPT. G. D. WALL
Harbour Master of the Port of Mackay.

As port authorities, we are all cognisant with the difficulties associated with leading beacons (with beacons of all types in fact). Amongst these we find outstanding the difficulty of seeing these beacons when the sun is behind them. We receive complaints from Masters of vessels about the difficulty of picking up marks, particularly those with an easterly or westerly bearing. Pilots also, have remarked on this difficulty with particular reference to leads and beacons such as I have described.

Surveyors, including engineers, harbour masters and others who carry out this work, know how exasperating it is to try to work on lines when the marks indicating these are subject to the disadvantages of the same natural phenomenon.

From time to time great inconvenience is incurred through the Master of some vessel dropping his anchor on a sewer pipe or picking up a submarine telephone cable because he has been unable to read the warning conveyed on a notice board which, with the sun behind it presents only one more dense shadow in a whole panorama of dark shadows. Dredge Masters find the same difficulty.

With these things in mind one of the Harbour Masters at this port set to work to try to improve the lot of harbour authorities and give greater assistance to mariners, and the following account shows how a satisfactory result was achieved:—

Principle of New Beacon

The roofs of houses first gave inspiration to Commander McKenzie, the Sydney engineer, when working on this problem. If you look at a house in the direction of the sun the first thing that will catch your eye is not the walls, but the roof, in fact it is the sunlight reflected by the roof which attracts attention. Another good analogy is the schoolboy and a small mirror. We have all seen youngsters seated in class near a window through which the sunlight is streaming reflecting the light into the eyes of pupils. Both these, the roof and the mirror, are examples of receiving light from a source beyond the object at which we are looking.

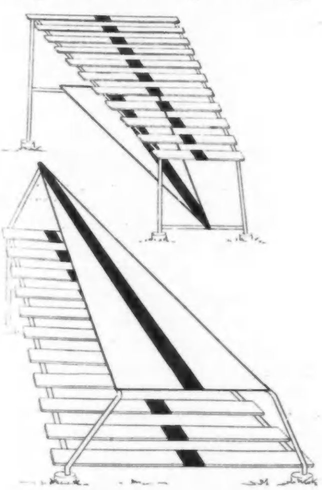
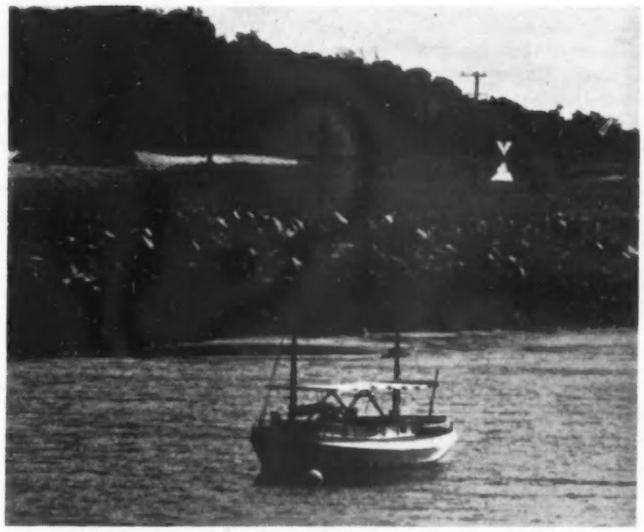


Fig. 1.—Sketch of the new "M. & W." Leading Beacon (not to scale).

Referring briefly to the laws of light it will be obvious that a conventional beacon, being nearly vertical, will reflect the light efficiently only when the sun is low and behind the observer. As the sun gains altitude the reflection approaches more nearly to the vertical where it is lost in the sea and surroundings below the beacon. In fact as the sun passes through the plane of the beacon, about mid-day, the rays of light pass parallel to the face of the beacon and do not strike it. From that point onwards the beacon face becomes an ever-deepening shadow in a whole panorama of shadows and is lost.

Now we all know that things are not always what they seem. The piece of tin (as illustrated in Fig. 1) is just another of those. At close quarters it has an individual (almost unique) look, but at a distance, it assumes a common shape, that of an equilateral triangle. In fact it takes the shape of a conventional front leading beacon.

In the morning when the sun is in front of it, diffusion of light causes it to show up as a conspicuous white mark. At noon, if the sun is directly overhead, there is admittedly a shadow on the lower louvre, but there is still so much white showing that it is quite conspicuous and in any case this shadow soon passes off.



Entrance Leads, Mackay, Queensland, 1/10/47.
Mackay 21° 7′ S. 149° 14′ E. Photo taken 1,300-ft. from front lead —2,700-ft. from back lead. Bearing of leads in line 248½°. Photo taken at 3.35 p.m., when sun bore 281°, altitude 33°. "M. & W." Leads one-fifth the size of conventional leads.

As the sun passes behind the beacon and loses altitude, however, the reflected rays play an increasingly important part till at about the middle of the afternoon the beacon reaches maximum brightness when the whole of the rays of the sun are reflected horizontally. At the time it is so very difficult to pick up the beacons now in use, the new beacon known as the "M & W" is at its brightest.

However, the brightness of reflection diminishes very slowly as the sun goes down, and as the sun passes through the angle at which the louvres are set (this angle remains constant for any particular beacon and is never altered) no light from the sun can fall on the louvres directly. In many cases this does not occur till only a short time before sunset, whilst in other cases, the louvres are in direct sunlight for the full time that the sun is visible. However, the usefulness of the beacon does not cease at this time, as the lower surface of the upper louvre is now in direct sunlight and the diffusion there is sufficient to throw a bright light on the lower louvre. By this means the sun's light is used throughout the full time the sun is above the horizon—not for about half that period as at present.

Reduction in Costs is Effected

A very vital matter to all harbour authorities is the cost of these beacons. Savings are effected in several ways by the patentees of the "M & W" Beacons. No doubt some of you have already wondered why the beacon was not made by tilting the old beacon backwards and stretching it so that it would still look like an equilateral triangle at a distance. I have already given one reason; the upper louvre lights up the lower one when the sun is near the horizon and behind the beacon. Another very important reason is that the beacon would become so long that money would have to be spent in additional stays. This has been obviated by dividing it into two louvres.

A further great saving has been made by reducing the effect of wind resistance. You will all be well aware that a large proportion of the expense of a present-day beacon is due to wind resistance. Heavy stays are necessary to support the triangle and these are very costly. To turn to an analogy in every-day life we all know that on a windy day it is very much harder to carry a sheet

*Summarised Abstract of a Paper read before the Association of Queensland Harbour Boards at Mackay, Australia, on 25th September, 1947.

Marine Beacons—continued

of iron across the wind when it is held under the arm on its edge, than it is to carry the same sheet of iron flat on your head. By reducing the angle the wind resistance is lowered.

Therefore we find that by reducing the angle towards the horizontal, a considerable saving has been effected in "M & W" Beacons. A consulting engineer has assured me that a few hundredweight will be ample to keep an "M & W" beacon securely anchored.

The materials used in the new beacon as recommended by the patentees, differ from those employed at the present time. A framework of galvanised piping is recommended. Galvanised iron for the reflectors is suggested. These galvanised products resist corrosion so well that they are almost everlasting. When covered with red lead and white paint this endurance is prolonged. Incidentally for "M & W" Beacons water paint is preferred to oil paints because it gives better diffusion of light. Water paints have the added advantage of being cheaper, but this is only a consideration.

Entrance Leads, Mackay, Queensland, 1/10/47.

Mackay 21° 7′ S. 149° 14′ E. Photo taken 1,300-ft. from front lead —2,700-ft. from back lead with telephoto lens at 8.5 a.m. Bearing of leads in line 248½°. At 8.5 a.m. sun bore 082° altitude 32°. "M. & W." leads on right are about one-fifth the size of the conventional ones. Conventional leads are about their best and "M. & W." about their worst at this time.

Materials other than galvanised iron may be used, of course. The final decision lies with the local authorities. Where timber slats similar to the present beacons are used, strong advice is given against the use of bolts, as these add so much to the upkeep costs, and an alternative method has been devised by the patentees.

Further, "M & W" Beacons may be much smaller than others, yet more effective, as explained later.

A few months ago an interesting comparison was made locally. The erection of a pair of the old type of beacons was quoted at £130. Quotations for the erection of a good permanent pair of "M & W" beacons ranged from £65 upwards—half the other price. Finally, a pair of temporary "M & W" beacons designed to last two years was erected for £10.

It is desirable that every individual beacon should receive specific attention. In the first place the desired range of each pair of beacons varies with natural circumstances from two miles or less to ten miles or more. In this connection a very interesting rule for general guidance has been determined by experiment. It has been found that for every foot of side of the equilateral triangle the naked eye visibility is increased one mile. This means that a triangle of 5-ft. base will be visible in a clear atmosphere for five miles without the aid of binoculars. Conversely a triangle which it is desired should be seen by the naked eye at ten miles should have a 10-ft. base. Now you will more readily appreciate the earlier remark that considerable saving can be effected by using the new type beacon, because being more efficient, it can be smaller.

The second reason why it is desirable to have individual specifications for each beacon is that the angle at which it is desirable to set the louvres varies with local circumstances. I wish to emphasise here that once set, this angle is decided for any particular beacon, and it is not adjusted from time to time, and that the variation of the angle occurs only between different beacons. Take the case of a beacon set at the foot of a steep hill in such a position that the true altitude of the sun setting behind the beacon is never, at any season, less than 40° above the horizontal. If the louvres of this beacon are set at any angle less than 40° then, in order to maintain perspective, there is waste of material, labour, and money. On the other hand in the case of a beacon set out on a sandbank far from the shore, the louvres should be set as low as possible in order that they shall be in direct sunlight as long as possible.

There are two limits to this angle. For the greater inclination consider the case of an overcast or foggy day. The light then falls vertically and the louvres would need to be set at 45° in order to reflect this horizontally. Incidentally, by setting the louvres like this, an "M & W" beacon is very much whiter and more conspicuous than beacons set at a greater angle. For this reason it is never set at a greater angle than 45°. On the other hand, the smaller the angle the more the beacon must be stretched in order to maintain the correct perspective. In other words, the greater the expenditure of materials, labour, and money. For this reason the louvres are not set at a lower angle than about 15° to 20°.

These beacons are just as readily fitted with Neon candles or other lights for night navigation as the present type.

Though I have referred only to triangular beacons in this paper, the same principles are applied to beacons of any shape with results as excellent, so that departure from established port practice is obviated.

The National Dock Labour Corporation Limited

Chairman's Address at Annual General Meeting

The eighth and last Annual General Meeting of the National Dock Labour Corporation was held in London on the 26th ult., and the following excerpts are taken from the opening speech of the Chairman, the Rt. Hon. Lord Ammon, P.C., D.L., J.P.:—

It is nearly 10 months since we handed over to our successors, the National Dock Labour Board. Your Directors and Officers have, in the meantime, been engaged in the complicated negotiations which were necessary to safeguard the interests of the Corporation's workers and staff prior to transferring to the National Board the very substantial funds and property which we have built up over the past 6½ years. The time has now come, however, when no useful purpose would be served by the continuance of the Corporation and resolutions to place our affairs in the hands of a Liquidator will be submitted to the members at a later meeting to-day.

It will be a source of great satisfaction to you that the value of the assets which the Corporation is in a position to pass on to the National Board exceeds £900,000. Indeed, but for our healthy condition which enabled us to make an interest-free loan of £100,000 to the new Board in July last, the launching of the permanent scheme might have presented some difficulty on the financial side. For although the Ministry of Transport showed a small surplus on the Merseyside Scheme, this was swallowed up many times over by the heavy losses on Clydeside. The Ministry was, therefore, unable to make any financial contribution to the National Board but I hope that, in the light of our example, they may still be persuaded to transfer their physical assets on Merseyside and Clydeside either at a nominal figure or without any charge whatever.

National Dock Labour Corporation—continued

The Conclusion of a Chapter.

The transition to the National Dock Labour Board has now been completed except for certain administrative matters which will be cleared in due course, and we have handed to our successors very considerable physical assets, a trained staff, and a labour force of 49,000 men, who under our Schemes, have become accustomed to the idea of obligations as well as privileges being a condition of a Dock Labour Scheme.

The transition has been effected smoothly and with no industrial disturbance; and although this was due in part to the fact that all the ports were busy at the time of the change-over, there were other important contributing factors. Your staffs in the ports and at Head Office bore the administrative burden of the change-over and worked assiduously and long to make sure that the mechanics of the Scheme functioned efficiently. The Unions through many meetings in branch, district and national committees, had accustomed the men to the permanency of the new Scheme that was to follow the temporary war-time Schemes. The Employers had showed wise leadership in helpful co-operation with the Unions and the Ministries in trying to devise and introduce a permanent Scheme to serve the best interests of the Industry.

Thus we conclude an important first chapter in the story of one of the most imaginative and revolutionary changes in the social history of this or any other country. The measure of our contributions as administrators is emphasised by the fact that so great and far-reaching a change has been so quickly effected.

Naturally, our concern in the survey submitted to you has been with our own ports; but any future narrative will, of course, detail the parallel story of the Dock Labour Schemes in the Mersey and Clyde administered by the Ministry of Transport. It is a dramatic and colourful story. The Ministry Schemes were, perhaps, more ruthlessly directed and limited to immediate war aims of the Scheme than those of the Corporation; consequently, much that was set up by the Ministry passed with the end of the war-emergency. Employers have regained their industrial independance and industrial negotiations have returned to the machinery of the appropriate local joint committees. The new Schemes carry forward the best of the Ministry Schemes and, indeed, are in some respects founded on experience gained thereby. But, even if there were nothing else to record, the work of the Ministry and its Regional Port Directors in devising and establishing the Port Medical Services and the Manchester Rehabilitation Centre will surely stand as a remarkable, imaginative and pioneer effort which has set a standard for all ports.

In Retrospect.

Having passed on our responsibilities, we meet to-day to wind up our affairs. But before finalising these matters, as I hope you will agree to do before we leave, I think we may justifiably look over the field of our operations, as an epilogue to previous surveys. I have found it interesting to re-read the speeches which Sir Ronald Garrett and I have made to these meetings. I do not think that, even with our longer experience, we would wish to re-write them; we might, of course, tone down some of the matters to which at the time we gave some prominence; we might wish to underline and enlarge upon others which we only noted in passing; but substantially the contents and the emphasis would remain.

There are two themes which run throughout the speeches; the first is the every-day problems of manning the ports for the quick turn-round of ships; the other is the observation to be drawn from our experience for the future—because it was always to be assumed that a permanent Scheme would follow.

Sir Ronald, for example, at the Second Annual General Meeting as early as 1942 laid down such a long-term principle when he said that "our aim must be to adjust the labour to the work," so that each worker has "the greatest possible measure of regular work. This is what the port workers themselves wish—they want work rather than attendance money." This idea, as you know, is now embodied in the very title of the Act—The Dock Workers (Regulation of Employment) Act.

Another long-term issue he raised was that the first "step to dealing with the problem" of decasualisation is the knowledge of the size and capacity of our labour force. We have certainly not solved that problem yet—perhaps we shall not be able to do so until we are further removed from the memories of the days of casual labour; until the men have more confidence in the future, and until the employers are prepared to work within the limitations of a restricted labour force. There has been considerable progress in using more fully a limited labour force; and an acceptance of the fact that, in the long run, it may be better to wait for the dock worker to be available than call on "green" labour. In many ports, Joint Advisory Committees guide the Local Boards how best to use the labour when it is known to be insufficient to meet all the current demands. But we have only touched the fringe of this general problem as yet. We know a little about the problem of "size"; we know possibly less about the capacity of our labour force, beyond the obvious facts about what the man does.

An integral part of this question is that of the mobility of the worker. The "size" of the labour force is multiplied considerably if labour is mobile. When I look back over our war-time experience in this connection, quite frankly I am amazed at the way the men moved and were moved from one port to another. I see that we reported to you that, in 1942, 17,000 men were moved in eight months—and that was not, at that time, exceptional. They were called on, at very short notice, to undertake long journeys in darkened trains to live in strange cities, to work under different port conditions, to handle strange cargoes—leaving their families at home in the knowledge that they might be subject to enemy attack. No wonder the men sometimes grumbled and often not without cause. However, the men showed that Mr. Bevin was very right not to form dockers' battalions but to rely on the civilian docker.

Under the new Scheme, as you know, transfers within reasonable daily travel are an obligation and long-distance transfers are now voluntary.

The other theme of the Chairmens' surveys—the facts of our achievement, as distinct from our aspirations are, I think, impressive. The Corporation was responsible for 70 ports; and in each port there had to be the organisation for the allocation of labour, taking proof of attendance, the payment of wages and all the other matters arising from the Scheme. The labour force, to which was eventually added Coal Trimmers, Fish Dock Workers and Riggers reached its peak in 1947, with an effective Register of 49,000. The Corporation paid out £60 million in wages, including £5¼ million in Attendance Money.

We had, of course, industrial difficulties to which reference was made from time to time at these meetings. They were particularly serious in war-time. But, having in mind the strain we were all enduring, the difficult conditions under which the men had to work, often away from home, the industrial war record of dockland is highly creditable. In retrospect, I think we should emphasise not our industrial difficulties during those years, but the growth of a new spirit in the Industry, of improved industrial relationships, and the response of the men to the welfare activities of the Corporation, which was significant of this change. Such development of good relationships can bode nothing but good for the Industry.

Working Conditions.

Unfortunately, the Corporation was unable to develop its welfare programme except in limited ways; it had no power to do so under the 1941 Scheme, and being later challenged, it had to secure an amending Order—all of which wasted valuable time. Further, the immediate tasks of Welfare Officers of billeting, feeding, domestic problems and the other urgent war-time jobs kept the staff fully occupied; and, of course, all personal activities were restricted during the war. But if our welfare programme were limited, your Directors have at best the satisfaction of seeing their views embodied in a Statement of Principle, which provides a Welfare Policy agreed with and, indeed, supported by the employers and the Unions—of which we can be rightly proud.

The importance attached to this as part of the Corporation's work was reflected in the references in several previous speeches to you and in the setting aside of a very considerable sum for this purpose. And I feel that the action of your Directors in this connection, which has always received your support in the past, justifies me in taking this opportunity of addressing for a moment our successors and indeed the Industry, as to future needs which are well within the Statement of Principles.

National Dock Labour Corporation—*continued*

The responsibility for Welfare does not rest wholly or indeed mainly with the Board; it rests primarily upon the men, the employers and all who share in this Industry. Unless there is active sharing of responsibility, personal effort and contributions from the individuals concerned, there cannot be a Welfare programme worthy of our support. Fortunately, the Industry has responded magnificently. The money raised every week by the men for hospitals, benevolent funds, national savings is amazing; the response of the men since the war to general educational and sports activities, for which they bear the major cost, is quite remarkable. And you will find employers sharing in all these affairs in the locality. The right spirit is there; and the smaller the port, the easier it is. The true basis of a Welfare Policy is there; and I am sure, therefore, that if the new Board can harness this good will and energy latent in the Industry, it will be able to realise the ambitions we have embodied in our Statement of Principles.

But we cannot rest content. There is much to be done. The state of the physical amenities of many of our ports is deplorable. Here and there, there are canteens and sanitary arrangements which reach a very high standard. In too many cases, the conditions are primitive, crude and a danger to health, and unworthy of the new status of the dock worker. There are many occasions and places where washing facilities consist only of a bucket of water. Medical facilities, except on the Merseyside and Clydeside, are generally limited to the first-aid box, although the accident rate among dockers is high.

The provision of improved working conditions is essential if we are to have an efficient labour force, just as essential as to have the right equipment, the proper lay-out of rail and road tracks, or an adequate supply of wagons. It is in this general field of provision, of canteens, washing and lavatory facilities, protective clothing, adequate lighting and such like that I suggest priority should be given if we hope to improve the working of the ports. This is an immediate programme which can be carried out only by the co-operation of the Port Authorities, the Employers, the National Board and the men. The National Board is moving forward rapidly with the Medical Centres; during the war, canteens were improved and many new canteens were built. I can only urge that these general programmes will be pushed forward as a matter of priority so that this possible criticism of our Industry will be removed.

Some of you can recall the very earliest days of the Corporation and will doubtless be doing so now, as you watch the permanent organisation carrying on the work you started. In most ports there are tales that are told of the starting up of the Scheme in the home port. Probably you will recall the first time you came to Upper Brook Street for the General Meeting. It was 15th December, 1941. Our Libyan Campaign was in full swing, although, as the Prime Minister said in the House, in a characteristic understatement, "it did not take the course which its authors expected." Ten days earlier, Japan had attacked Pearl Harbour; at sea we had recently lost the "Repulse" and the "Prince of Wales"; Russia, after six weeks of hard fighting, and been driven from her main armament-producing centres; at home we were bombarded nightly. Those were the circumstances in which you met.

It was a critical time for our Industry. We were almost a beleaguered nation; the English Channel, North Sea and the Mediterranean were all but closed to shipping; the U-boat attack was mounting in the Atlantic and our shipping losses had been heavy. Yet from these islands we had to send supplies by the "long haul" to our allies and armies—by the Northern Arctic route to Russia, round the Cape to our armies in Egypt, Persia and the countries of the Near East, and to threatened Australia and the Far East. It is not surprising that your then chairman, Sir Ronald Garrett, in his address to you said—again with the Englishmen's characteristic understatement—"the circumstances in which we meet are a little unusual".

Yet from that Meeting has emerged a Scheme which now covers every port in this country, which has been willingly and gladly accepted by the majority of the men and the Employers, which has decasualised the dock worker and given a new dignity to this industry, worthy of the best men engaged in it. It has even gone further afield. The Scheme has been discussed by the Trade Unions of Europe; it is echoed in a Scheme introduced in France last year; in Belfast where we had gladly supplied information as to our practice and experience; in the Channel Islands, which now have their own Scheme; in Australia, New Zealand, Ceylon, Rangoon, Nigeria and Iraq, whence Labour and other Officers of the Government and students have come to us to study our methods.

If this is a source of satisfaction to us, how much more would this day have given happiness to the pioneers in dockland—to Ben Tillet, James Sexton, Harry Gosling, Dan Hillman, Dan Milford—and the thousand un-named men, and the many Employers who had visions of some such ideal, but who themselves only knew the bitterness and rough and tumble of their day. So, as we pass on our responsibilities to our successors as they passed on theirs to our generation. I think we may do so in the knowledge that we should not be held by them to have failed in our task.

Southampton Marine Air Terminal

Return of B.O.A.C. Flying Boats

The opening of the British Overseas Airways Corporation's new flying boat terminal at Berth 50, Southampton Docks, marks the return of the Empire flying-boat services to the Port of Southampton after an interval of more than eight years.

Imperial Airways, first flying boat terminal was established at Berth 108, Southampton in 1936-7 with the introduction of the Empire or C Class boats. Soon after war broke out services were transferred to Poole where they have since remained.

At the end of the war plans were made for a return of the flying boat terminal to Southampton and from here 16 services a week (8 inward and 8 outgoing) will at present operate each week, increasing to 22 when the new Speedbird flying boat service to South Africa, with three services a week each way, is in full operation.

Operational Economies

By the transfer from Poole to the new terminal at Berth 50 considerable economies in operation have become possible, as well as a great increase in convenience for flying boat passengers. Berth 50 is an hour nearer London than Poole, with a direct rail spur linking the terminal with the main Bournemouth line to London, which is an hour-and-a-half from Southampton by express train of British Railways (Southern Region).

Berth 50, moreover, is two miles nearer the alighting area on Southampton Water than the pre-war marine base at Berth 108, thus reducing taxying distance. The biggest saving of all will be made by the elimination of the dead flying between Poole, the old passenger departure point, and Hythe, where the flying boats are overhauled and maintained. This saving is estimated to be £80,000 a year.

At the same time, the new terminal will be able to handle all existing or anticipated traffic with 50 per cent. fewer staff than were needed at Poole—167 all ranks instead of 330. It will be possible to cut by half the transport mileage of B.O.A.C. motor coaches and other vehicles serving the base. As the flying boats will taxi out to the alighting area from the floating pontoons under their own power and will be hauled in by electric winches at the end of their voyages, the use of launches will be largely eliminated. Duplication of engineering and marine staff both at Hythe and Poole will no longer be necessary.

Smooth Traffic Handling

The Berth 50 terminal building is designed to be capable of dealing with two flying boat departures or arrivals, or with a departure and an arrival, simultaneously. It can clear two sets of between 22 and 34 passengers, either incoming or outgoing (according to the type of flying boat being used), at half-hour intervals, and it is capable of handling smoothly at least 1,000 passengers a week, as well as providing accommodation for relatives or friends while they await arrivals or departures.

Southampton Marine Air Terminal—continued

Rooms for discharging Customs, immigration, passport, health and other port formalities are duplicated so that the movements of incoming and outgoing passengers do not overlap. Outgoing passengers pass down covered ways to the flying boat pontoons, their baggage following them on electric trolleys. Passengers pass to the rear of the building direct from the railway platform, where trains arrive and depart for London.

Improved Passenger Facilities

Outward-bound passengers arriving by train assemble in a reception lounge before passing through Customs, immigration, passport and health departments, to be "cleared" for their voyage. When they reach the Customs hall they find their luggage already awaiting them.

Port formalities completed, they proceed to another lounge, thence via a covered way and bridge to the floating pontoon where the flying boat is awaiting them. When they and their baggage, with the aircraft's complement of freight and mail, are aboard, the engines are started up and the flying boat taxies out for the take-off.

Incoming flying boats taxi to the mooring point, where the mooring rope is secured to a mooring buoy by the Radio Officer through the mooring hatch. A small power-boat links the tail release hook to two twin steel hawsers which are attached, one on either side, to electric winches at the rear of the dock. The winches are driven by an electric motor which is regulated to counteract the strength of the wind and current as the flying boat is hauled evenly into the dock. The rubber mooring buoy, which operates on a snatch block system, is drawn in at the same time as the boat.

Incoming passengers go by a separate route to a reception lounge as a prelude to completing the port formalities. These over, the passengers pass into another lounge equipped with telephone and cable facilities and other amenities, with the cashier's office adjoining for changing currency.

Restaurant and Lounge.

The restaurant and lounge bar on the first floor have a glass front facing towards Southampton Water and running the whole 110-ft. of the facade. The restaurant will seat 68 passengers and the lounge bar 65. Adjoining the restaurant are kitchens, catering stores and ancillary services, with an electric hoist communicating with the ground floor. At the rear is a senior staff mess and clerical and industrial canteens.

The remainder of the first floor is devoted to technical and administration accommodation—offices of the Ministry of Civil Aviation Airport Commandant, the B.O.A.C. Station Superintendent, B.O.A.C. signals, teleprinters, telephone exchange and telecommunications supervisor, with the M.C.A. Flying Control organisation in a tower at the other end of the building and other M.C.A. services on the same floor.

Careful arrangements have been made for dealing expeditiously with incoming and outgoing cargo and mail and a Customs transit shed is to be established on the south-west corner of the building.

Although its anticipated life is five years, Berth 50 is likely to remain Britain's Number One flying boat terminal for some years. It is capable of handling all anticipated traffic and of accommodating all types of flying boat now in service or currently contemplated. Even when the Government has decided on the site for Britain's ultimate flying boat terminal considerable time must necessarily elapse before its construction can be carried out.

In preparing Berth 50 for use, most valuable co-operation has been given to B.O.A.C. by the Southampton Harbour Board, British Railways (Southern Region), H.M. Customs and Immigration Authorities and the Southampton Corporation.

Radar for Tay Ferries

Installation of Equipment on M.V. "Abercraig"

It will be recalled that in the December, 1947, issue of this Journal, brief reference was made to the installation of Marine Radar to assist the working of the Tay Ferries. Now, through the courtesy of Mr. Alexander Smith, A.M.I.C.E., General Manager & Engineer to the Dundee Harbour Trust, we are able to give the following additional details.

Traffic on the Tay Ferries has been increasing at a steady rate since the end of the war and has now reached such a volume that, even under normal weather conditions, with the two small paddle steamers and the large modern motor vessel, there is considerable congestion of traffic, resulting in loss of time in sailings and in loss of revenue. To further complicate matters, the river is at times subject to intense fog, when visibility may be reduced to about 30-50 yards, and, under these conditions, there has been until recently no alternative but to cancel all sailings. The result was a disgruntled public—both from the point of view of passengers and of commercial users—with a consequent drop in the efficiency of the service.

To overcome these difficulties, the Dundee Harbour Trustees, who operate the Tay Ferries, enquired into the efficiency of Radar as an aid to navigation, and after thorough investigation decided to proceed with the installation of suitable apparatus on the motor ferry vessel, *Abercraig*.

Due consideration was given to the alternative possibilities of shore-based or ship-based Radar Equipment. The principal objections to a shore-based station were:—

(a) No suitable site was available at the Dundee end for the construction of a station.

(b) Maintenance costs and difficulties of manning of shore station.

(c) Width of river—two miles—precludes the use of any but the 3 mile scale on the radar screen.

(d) A shore station involves the provision of V.H.F. radio telephonic communication between ships and shore, so that additional complicated equipment has to be maintained.

(e) Ship Masters are completely dependent on radio communication, which might easily fail to work, although the radar is in perfect order.

Accordingly, an order was placed for a ship-based Cossor Marine Radar on 6th November, 1947, and the whole of the equipment was delivered, installed, tested and put into service by the 6th December, 1947.

As explained above, the principal use to which the equipment will be put is the maintenance of the ferry service during fog.

Although few vessels navigate the River Tay in the vicinity of the ferry crossing, apart from the ferry vessels themselves, there is the difficulty of circumventing the Middle Bank, a sandbank which is exposed at low water and situated on the direct line between Dundee and Newport, and of approaching the piers at either side of the river when a strong cross tide is running. As coast lines, piers, ships, buoys, sandbanks, etc., will all be clearly visible on the Radar Screen, the difficulties of navigation under conditions of fog will be considerably lessened, and it will be possible to carry on at least modified sailings even during the worst weather conditions. The Radar Equipment will also be of considerable assistance on dark nights, when driving squalls of rain, hail or snow are experienced.

During the short time the M.V. *Abercraig* has been on service since the fitting of the Radar Equipment, it has become apparent that it will be of considerable assistance in the navigation of the river under adverse weather conditions. The simplicity of operation has enabled the Masters of the vessel to become quickly conversant with its working, and during periods of dense fog last month, when visibility was reduced at times to 20 yards, the M.V. *Abercraig* was able to maintain its regular passage without either loss of passage or delay in the crossing over normal schedule.

It is only intended to fit Radar on one of the two existing paddle steamers, and this installation is to be fitted in the near future. It has also been decided to specify a similar installation for the projected new motor ferry vessel, for which tenders have been invited. It is hoped that this new vessel, which will be of a similar type to the *Abercraig*, and of approximately the same dimensions, will be in service within about 18 months to two years.

Notes of the Month

Plymouth as Liner Port.

It has been announced that liners of the Pacific Steam Navigation Company are to use Plymouth as their regular port of call on their homeward voyages from South America. By calling at Plymouth, the passengers will land in England 24 hours earlier than if they go straight to Liverpool as hitherto.

Free-Port in Szczecin for Czechoslovakia.

Under the recently concluded Polish-Czechoslovak pact of friendship and collaboration, an area in the free-port of Szczecin (Stettin) will be leased by Czechoslovak industrial and commercial interests. In order to adapt the area for transhipment of Czech goods, investment works are to be carried out by Czechoslovakia. There are plans to build a new completely equipped port basin in the Debicki canal, forming a part of the free-port.

Traffic at the Port of Vancouver.

According to the Annual Report for the port of Vancouver, compiled by the Vancouver Merchants' Exchange, 814 deep sea vessels, of 3,429,508 tons, entered the port during 1947, compared with 701, of 2,948,270 tons, in 1946, and 870, of 3,429,908 tons, in 1938. Exports from all principal British Columbian ports during the year totalled 4,272,103 tons, a decrease of 260,000 tons compared with 1939. In the same period imports have risen from 1,583,601 tons to 2,127,857 tons.

Large New Dry Dock for Holland.

The largest dry dock in Holland will be built at Vlissingen (Flushing) by the Royal Shipbuilding Company De Schelde. The dock will be 30 meters (98 feet) wide and 260 meters (850 feet) long and will be able to accommodate the largest Dutch liners. It will be located at Flushing Island, where most buildings were destroyed during the war. The plans for the dock are being drawn up by the Company De Schelde in consultation with the Dutch Government.

Reconstruction of Quay at Colchester.

As part of a long-term policy, the Colchester Harbour Committee have decided that it will be necessary to proceed with reconstruction of the whole of the existing King Edward Quay with sheet steel piling, at an estimated cost of £90,000. Immediately necessary repairs are to be put in hand at an estimated cost of £10,000, subject to consent of the Ministry of Transport. The Corporation are to take steps to obtain powers to increase the tonnage and wharfage rates and coal dues in connection with the harbour.

Improvements at the Port of Houston, U.S.A.

It was recently stated in the American Press that a project to widen and deepen the Houston Ship Channel, is moving nearer to realization. It is part of an ambitious development programme several phases of which are already in hand. An initial phase has been approved by the House of Representatives for widening the channel by 100 feet along a stretch of twenty-five miles. This part of the work will ultimately cost more than $5,000,000, and a further project to deepen the channel from 34 to 36 feet has been agreed and now awaits approval by the House and Senate.

The Rehabilitation of Polish Ports.

Under a Dutch-Polish trade agreement, effective from 1st January last, Holland has agreed to supply Poland with ships and harbour equipment totalling 25 mill. guilders in exchange for coal. This amount includes orders already placed. The agreement is valid for three years, and deliveries of coal will be spread over this period. Poland has already purchased three second-hand dredgers, two tugs and machinery to help in the rebuilding of her ports. Orders have also been placed with various Dutch yards for 22 river craft consisting of 13 single-screw tugs of 150 h.p. and 9 larger twin-srcew tugs of 500 h.p. Harbour equipment on order includes several large floating cranes for loading coal and iron-ore. These will have a radius of 20 m. and will have a lifting capacity of 10-tons.

Newcastle Quay Development Plans.

As part of its development plans for Newcastle Corporation quays, the Newcastle Trade and Commerce Committee is shortly to invite tenders for the supply of cranes and other equipment. Further improvements are subject to Ministry of Transport approval.

Venezuelan Port Improvements.

According to reports issued to the press the Venezuelan Government has approved the expenditure of $4,000,000 for the improvement and modernisation of port facilities at the Port of Maracaibo. Most of the appropriation will be spent on the construction of new bulkheads, several large piers, warehouses and offices for customs officials.

Cranes for the Port of London.

The Port of London Authority have ordered 30 3-ton electric quay cranes which will have a maximum radius of 80 feet and a track of 13 feet 6 inches. The 50 quay cranes ordered in November, 1944, are now in use and this further order envisages the requirements at berths likely to come into commision within the next year or two as repairs are completed.

Engineers Appointments Bureau.

A report of the work of the Professional Engineers Appointments Bureau states that during 1947 the average number of engineers on the register was 634, 127 of these being primarily civil, 260 mechanical, and 247 electrical engineers has thus been approximately two-thirds of the total for 1946, when the average was 964. A satifactory number of vacancies has again been notified by employers, the total for the year being 1048. Despite the reduced number of engineers available for nominations, the income from appointment fees increased by 10 per cent., compared with the previous year, the sum of £1,179 being received from 214 engineers. The Bureau has been incorporated as a company under limited guarantee.